Complete Course Grid and Syllabus

Diploma in Fire and Safety Engineering

Assam Energy Institute, Sivasagar

Course: Diploma in Fire and Safety Engineering

Total Number of Credits: 335

SEMESTER I					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
MA101	Mathematics-I	3	1	0	11
PY101	Physics-I	3	1	0	11
CY101	Chemistry-I	2	1	0	8
ME101	Engineering Mechanics	2	1	0	8
CS101	Fundamentals of Computer Engineering	2	0	2	8
ME103L	Engineering Workshop Practices Laboratory	0	0	3	3
CY101L	Chemistry Laboratory	0	0	2	2
TOTAL					**51**
HU101	Universal Human Values	1	1	0	5
HU102	Communication Skills*	2	0	1	7

*For selective students with less proficiency in English

SEMESTER II					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
MA102	Mathematics-II	3	1	0	11
PY102	Physics-II	3	1	0	11
CY102	Chemistry-II	3	0	0	9
EIE101	Fundamentals of Electrical and Electronics Engineering	3	1	0	11
CS102	Computer Programming	2	0	2	8
ME102L	Engineering Drawing	0	0	3	3
PY101L	Physics Laboratory	0	0	2	2
EIE101L	Fundamentals of Electrical and Electronics Engineering Laboratory	0	0	2	2
TOTAL					**57**
HU103	Community Internship	1	1	0	5

SEMESTER III					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
FSE201	Fire Codes and Standards	3	0	0	9
ME203	Materials Science and Engineering	3	0	0	9
CE201	Unit Operations -I	3	1	0	11
ME205	Engineering Thermodynamics	3	0	0	9
FSE202	Explosions and Industrial Fire Safety	3	0	0	9
CE201L	Unit Operations Laboratory-I	0	0	2	2
FSE203L	Fire Ground Operations – I	0	0	3	3
FSE204	Group Discussion	0	0	2	2
TOTAL					**54**

SEMESTER IV					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
FSE205	Fire Hydraulics and Suppression System	3	0	0	9
FSE206	Fire Dynamics	3	0	0	9
FSE207	Fire Detection System and Electrical Safety	3	0	0	9
FSE208	Safety in Construction	3	0	0	9
CE206	Unit Operations - II	3	1	0	11
FSE209L	Fire Ground Operations – II	0	0	3	3
FSE210	Project	0	0	5	5
FSE211	Seminar	0	0	2	2
TOTAL					**57**

SEMESTER V					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
FSE301	Disaster Management and Emergency preparedness	3	0	0	9
FSE302	Hazard Identification and Risk Analysis	3	0	0	9
FSE303	Health, Safety and Environment	3	0	0	9
FSE304	Smoke Management System	2	0	0	6
HU301	Humanities	2	0	0	6
HU302	Engineering Economics	2	1	0	8
FSE305L	Fire Ground Operation – III	0	0	3	3
FSE306	Project	0	0	5	5
FSE307	Industrial Training	0	0	5	5
TOTAL					**60**

SEMESTER VI					
Course Code	Subjects	L	T	P	Credits
FSE309	Modeling and Simulation of Enclosure Fires	3	0	0	9
CE308	Industrial Pollution and Control	3	0	0	9
FSE310	Legal Aspects of HSE	3	0	0	9
FSE311	Incident Investigation and Safety Audit	3	0	0	9
	Departmental Elective-I	3	0	0	9
	Open Elective	3	0	0	9
CE308L	Industrial Pollution and Control Laboratory	0	0	2/2	1
FSE309L	Simulation of Fires in Enclosures Laboratory	0	0	2/2	1
TOTAL					56

Department Elective/Open Elective	
FSE312	Fundamentals of Environmental Impact assessment
FSE313	Occupational Health and Industrial hygiene

Category	Diploma in Fire and Safety Engineering	Credits
HU	Humanities and Social Science	31
MA	Mathematics	22
PY	Physics	24
CY	Chemistry	19
	Institute Requirement Engineering	89
	Engineering Drawing (Manual and Computer Aided), Manufacturing Practices and Practice course of Department	6
FSE	Departmental Core	124
	Departmental Elective	9
	Open Elective	9
	Project/ Industrial visit/ Training/Seminar/Group Discussion	19
Total		**352**

**Institute Requirement Engineering**				
Course Code	**Subjects**	**Semester**		**Credits**
		Odd	**Even**	
ME101	Engineering Mechanics	Odd		8
CS101	Fundamentals of Computer Engineering	Odd		8
EIE101	Fundamentals of Electrical and Electronics Engineering		Even	11
CS102	Computer Programming		Even	8
EIE101L	Fundamentals of Electrical and Electronics Engineering Laboratory		Even	2
ME203	Material Science and Engineering	Odd		9
CE201	Unit Operations -I	Odd		11
ME205	Engineering Thermodynamics	Odd		9
CE204L	Unit Operations Laboratory-I	Odd		2
CE206	Unit Operations -II		Even	11
CE308	Industrial Pollution and Control		Even	9
CE308L	Industrial Pollution and Control Laboratory		Even	1
\multicolumn{4}{c}{**Total**}			**89**

**Engineering Drawing and Engineering Workshop Practices Course of Department**				
Course Code	**Subjects**	**Semester**		**Credits**
		Odd	**Even**	
ME103L	Engineering Workshop Practices Laboratory	Odd		3
ME102L	Engineering Drawing		Even	3
\multicolumn{4}{c}{**Total**}			**6**

Syllabus

Semester I

Mathematics-I

1.1 Course Number: MA101

1.2 Contact Hours:3-1-0   Credits:11

1.3 Semester-offered: 1st Year –Odd

1.4 Prerequisite: Class 10th level Mathematics

1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. Objective:

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Co-ordinate Geometry, Complex Numbers, Differential Calculus and Vector Algebra.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Trigonometry**	Concept of angle; Measurement of angle in degree, grades and radians and their conversions; Trigonometric ratios; Sum, difference formulae and their applications (Without proof); Product formula (Transformation of Product to Sum and Differences and vice versa); Trigonometric Ratios of multiple angles, sub-multiple angles (2A,3A, A/2); Graph of sinx, cosx, tanx, cosecx, secx and cotx., Basic concept of inverse trigonometric functions.	8
2	**Co-ordinate Geometry**	Equation of straight line in various standard form (Without Proof); Intersection of two straight lines Angle between two straight lines; Parallel lines and perpendicular lines; Perpendicular distance formula Sections of a cone: Circle, Parabola, Ellipse and Hyperbola; General equation of a circle and its characteristics; Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations (without proof).	8
3	**Complex Numbers**	Definition of Complex numbers; Real and imaginary parts of a Complex number; Conjugate of a complex number; Modulus and amplitude of a complex number; Addition, Subtraction, Multiplication and Division of complex numbers, Polar and Cartesian form of a complex number and its conversion from one form to other, De-Movier's theorem and its application.	7
4	**Differential Calculus**	Definition of function; Concept of limits; Four standard limits $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a}, \lim\limits_{x \to 0} \dfrac{\sin x}{x}, \lim\limits_{x \to 0} \dfrac{a^x - 1}{x}$ $and \lim\limits_{x \to 0}(1 + x)^{1/x}$, Differentiation of $x^n, \sin x, \cos x, e^x$ $and \log_a x$ by the first principle rule of derivative, Differentiation of sum, product and quotient of	12

		functions; Differentiation of function of a function; Differentiation of trigonometric and inverse trigonometric functions; Logarithmic differentiation; Exponential functions.Definition & meaning of partial derivative. Evaluation of partial derivatives. Definition & examples of homogeneous functions. Euler's theorem (1st order) on Homogeneous functions for 2 variables (without proof). Problems.	
5	**Vector Algebra**	Definition, notation and rectangular resolution of a vector; Addition and subtraction of vectors; Scalar and vector products of 2 vectors; Simple problems related to work; moment and angular velocity.	6
		Total	**41**

4. Reading

4.1 Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40th Edition, 2007.
2. Mathematics Textbook for Class XI and XII (NCERT).
3. S. L. Loney, The Elements of Coordinate Geometry Part-1 Cartesian Coordinate.

4.2 Reference Books:

1. R. D. Sharma, Mathematics for Class 11and 12.
2. E. Kreyszig, Advanced Engineering Mathematics, Khanna Publisher.
3. Murray R. Spiegel, Robert E. Moyer, College Algebra, Tata McGraw Hill, New Delhi, 2nd Edition, 2000.
4. Frank Ayers, Elliot Mendelson, Calculus, McGraw Hill, New York, 4th Edition.

5. Outcome of the Course:

After the completion of the course the students will be able to

1) Solve problems involving angles, triangles, and periodic phenomena using trigonometric functions. Apply trigonometry in real-world situations, such as navigation, physics, and engineering
2) Understand the cartesian coordinate system and the relationship between points, lines, and curves. Represent geometric figures using equations and inequalities.
3) Understand the concept of a derivative as the rate of change and slope of a function.
4) Apply complex numbers in solving equations and expressing solutions.
5) Understand the geometric and algebraic properties of vectors.

Physics-I

1.1 Course Number: PY101
1.2 Contact Hours: 3-1-0   Credits:11
1.3 Semester-offered: 1st Year - Odd
1.4 Prerequisite: Class 10th level Physics and Mathematics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Physics is the mother of all engineering disciplines hence students must have a fundamental understanding of the topic in order to grasp their core engineering diploma subjects more readily. As a result, while reviewing the curriculum, emphasis was placed on the concepts, laws, working equations, and basic notions of physics to assist students in studying the key courses. This will give a solid foundation for future self-development in order to cope with new advances.
ii) The course material places a strong emphasis on the practical application of physical concepts and analysis in a variety of engineering and technological sectors.
iii) The course will assist diploma engineers in using fundamental ideas and principles to tackle complex engineering issues and comprehend various technology-based applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Units and Measurements**	Physical quantities: Fundamental and derived, Units and systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis. Measurements: Need, Measuring instruments, Least count, Types of measurement (direct and indirect), Errors in measurements (systematic and random), Absolute error, Relative error, Error propagation, Error estimation and significant figures.	8
2	**Scalars and Vectors**	Scalar and Vector quantities: Examples, Representation of vectors, Types of vectors, Addition and Subtraction of Vectors, Triangle and Parallelogram law, Scalar and Vector product,	7

		Resolution of a vector and its application to inclined plane. Kinematics equations in scalar and vector form with related numerical problems.	
3	**Force and Motion**	Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, Rockets, Impulse and its applications. Circular motion, Angular displacement, Angular velocity, Angular acceleration, Frequency, Time period, Relation between linear and angular velocity, Linear acceleration and angular acceleration (related numerical), Centripetal and centrifugal forces with live examples. Moment of inertia and its physical significance, Definition of torque and angular momentum and their examples.	8
4	**Work, Power and Energy**	Work: Concept and unit, Examples of zero work, Positive work and negative work. Friction: Concept, Types of friction, Laws of limiting friction, Coefficient of friction, Reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane (for rough and smooth surfaces) and related applications. Energy and its unit, Kinetic energy, Gravitational potential energy with examples and derivations, Mechanical energy, Conservation of mechanical energy for freely falling bodies, Transformation of energy (examples). Power and its unit, Power and work relationship, Calculation of power (numerical problems).	7
5	**Properties of Matter**	Elasticity: Definition of stress and strain, Moduli of elasticity, Hooke's law, Significance of stress-strain curve. Pressure: Definition, Unit, Atmospheric pressure, Gauge pressure, Absolute pressure, Fortin'sBarometer and its applications. Surface tension: Concept, Unit, Cohesive and adhesive forces, Angle of contact, Ascent Formula, Applications of surface tension, Effect of temperature and impurity on surface tension. Viscosity and coefficient of viscosity, Terminal velocity, Stokes' law and effect of temperature on viscosity, Application in hydraulic systems. Hydrodynamics: Fluid motion, Streamline and turbulent flow, Reynold's number, Equation of continuity, Bernoulli's Theorem (formulae and numerical problems) and its applications.	12
Total			**42**

4. Readings

4.1 Textbooks:

1. Textbook of Physics for Class XI (Part-1, Part-2); N.C.E.R.T., Delhi.

4.2 Reference Books:

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by H. C. Verma, Vol. I&II, Bharti Bhawan Ltd., New Delhi.
3. Engineering Physics by P. V. Naik, Pearson Education Pvt. Ltd, New Delhi.
4. Engineering Physics by D. K. Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi.
5. Comprehensive Practical Physics, Vol, I & II, J. N. Jaiswal, Laxmi Publications (P) Ltd., New Delhi.
6. Practical Physics by C. L. Arora, S. Chand Publication.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Explain and identify physical quantities along with their units and make measurements with accuracy by minimizing different types of errors.
2) Understand the scalar and vector quantities and use this knowledge in solving relevant real-life problems.
3) Describe the types of friction, its coefficients and methods to reduce or increase friction between different surfaces.
4) Analyze different types of motion, acting forces along the motion and conservation of momentum principle to describe rocket propulsion, recoil of gun etc.
5) Compare and relate physical properties associated with linear motion and rotational motion along with the application of conservation of angular momentum.
6) Understanding of relationships for work, energy and power and solve related problems. Explain the principle of conservation of energy also identify various forms of energy, and energy transformations.
7) Describe the phenomenon related to properties of matter such as pressure, surface tension, stress, strain, elasticity, viscosity and their effect.

Chemistry-I

1.1 Course Number: CY101
1.2 Contact Hours: 2-1-0   Credits:8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Chemistry and Mathematics
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To impart the knowledge of fundamental principles of chemistry for future learning of engineering principles
ii) To make students realize the importance of fundamental chemistry in engineering disciplines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Atomic Structure**	Atomic number, isotopes and isobars. Thompson's modeland its limitations, Rutherford's model and its limitations, Bohr's model and its limitations Quantum number, Aufbau principle, Hund's rule, Pauli's exclusion principle, electronic configuration.	5
2	**Periodic Properties of Elements**	Classification of Elements, Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements -atomic radii, ionic radii, inert gas radii Ionization enthalpy, electron gain enthalpy, electro negativity, valency. Nomenclature of elements with atomic number greater than 100. Basic Concepts of s, p, d and f-block Elements	6
3	**Chemical Bonding and Molecular Structure**	Orbit vs. Orbital, Valence electrons, ionic bond, covalent bond; Lewis structure, polar character of covalent bond, covalent character of ionic bond, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, Valence-Bond Theory.	6
4	**Concept of Moles and Chemical Equation**	Phases, Mole concept and problems, Standard solution, normal solution and molar solution, concentration terms-normality, molarity, gm/l, ppm, normality equation, acid-base titration. Chemical equation-definition, qualitative and quantitative significance, limitations, balancing by partial and ion-electron method, electronic concept of oxidation and reduction, Stoichiometric calculations.	5

5	**Acids-Bases and Salt**	Acids, bases and salts, Theories of acids and bases- Arrhenius, Bronsted-Lowry, Lewis theory, Strong acids and strong bases, Concept of pH and pKa, conjugate acid-base pair, classification of salts, hydrolysis of salts and its effect, Concept of Buffer, Indicator.	4
6	**Phase of Substances**	Kinetic Theory of gases, Boltzmann distribution, Ideal gas & Real gas, Types of solutions (solution, dispersion, colloids), expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties – relative lowering of vapour pressure, Raoult's law , elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Vant Hoff factor. Micelle, lipid bilayer. Applications of Micelles	6
Total			**32**

4. Readings

4.1 Suggested Readings:

1. NCERT Textbook (Class XI and XII)
2. Engineering Chemistry, B. K. Sharma
3. A Textbook of Engineering Chemistry, Sashi Chawla
4. Engineering Chemistry, Jain and Jain
5. Applied Chemistry, Dr. Raman Rani Mittal

5. Outcomes of the Course:

After completion of this course students will be able to

1) Know about the structure of an atom and write the electronic configurationsof atoms.
2) Understand the variation of physical and chemical properties of elements such as ionization potential, electron affinity, electro negativity and learn about the periodic table.
3) Understand chemical bonding, concept of hybridization, as well as structure and shape of molecules.
4) Impart knowledge about various atomic and molecular quantities, strength and balancing chemical reaction.
5) Explore acid-base chemistry with a focus on the equilibrium aspects of these reactions.
6) Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of particles. explain the laws governing behaviour of ideal gases and apply gas laws in various real-life situations. Understand the properties of liquids in terms of intermolecular attractions.

Engineering Mechanics

1.1 Course Number: ME101

1.2 Contact Hours: 2-1-0   Credits: 8

1.3 Semester-offered: 1st Year –Odd

1.4 Prerequisite: Class 10th level Physics & Mathematics

1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar
   Singha, Dr. Abhimanyu Kar & Dr. Karthik Babu NB

2. Objective:

i) To develop the ability to model and analysis of mechanical engineering systems using vectorial representation of forces and moments.

ii) To be able to draw free-body diagrams of mechanical components and systems.

iii) To develop the capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

iv) To understand the phenomenon of friction and the ability to solve problems related to the same. Ability to apply the principles of virtual work.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics and statics of particles**	Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vector representation of forces –Vector operations of forces – additions, subtraction, dot product, cross product –Coplanar Forces – rectangular components – Equilibrium of a particle – Forces inspace – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.	7
2	**Equilibrium of rigid bodies**	Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions	7
3	**Properties of surfaces and solids**	Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, and Hollow section by	7

		using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section –Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.	
4	**Dynamics of particles**	Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Simple problems – Impact of elastic bodies.	7
5	**Friction and rigid body dynamics**	Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder and disc/wheel.	7
	Total		35

4. Readings

4.1 Textbooks:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

4.2 References Books:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

5. Outcome of the Course:

On successful completion of this course, the student will be able to

1) Illustrate the vectorial and scalar representation of forces and moments
2) Analyse the rigid body in equilibrium
3) Evaluate the properties of surfaces and solids
4) Calculate dynamic forces exerted in rigid body
5) Determine the friction and the effects by the laws of friction

Fundamentals of Computer Engineering

1.1 Course Number: CS101
1.2 Contact Hours: 2-0-2   Credits:8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Basic knowledge of computers
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi

2. Objective:

The aim of the course is to help the students to attain the following basic competency through various teaching-learning experiences:

i) Identifying and learning about various computer hardware and their uses.
ii) Understanding of computer memory and its internal architecture.
iii) Basic knowledge of software including different operating systems and its working.
iv) Introduction to web designing using HTML coding.
v) Developing awareness regarding cyber security.
vi) Evolving logical thinking and problem-solving skills.
vii) The course will assist diploma engineers in using fundamental ideas and principles to tackle complex engineering issues and comprehend various technology-based applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Computer Organization**	Introduction to generations of computer and its classification, Logical organization of computer (functional block diagram), Input & Output devices (keyboard, mouse, joystick, scanner, OCR, OMR, MICR, barcode reader, web camera, monitor, printer, plotter), Central processing unit.	5
2	**Memory & Architecture**	Primary, secondary and auxiliary memory, Main memory unit, RAM, ROM, Cache memory, Registers, System bus, Hard disks & optical disks, CPU, SMPS, Motherboard, Ports and Interfaces, Expansion cards, Ribbon cables, Memory chips,	4

		Processors.	
3	**Human Computer Interface**	Types of software (System and application), Operating system as user interface, Types of operating systems (Window, Linux, Mac), MS Office (Word, Excel, PowerPoint), Unix Shell and Commands, Programming languages, Compiler, Interpreter, VI editor, Computer viruses and its type, Detection and prevention of viruses.	5
4	**Computer Networks & Web Design**	Internet, TCP/IP, World Wide Web, Browser, Internet address (Domain name, URL), Search engine. Introduction to computer networks, Data communication and its components, Data transmission mode, LAN, MAN, WAN, Wireless LAN, Client/server network and peer-to-peer network, Intranet, Extranet. Hyper Text Mark-up Language (HTML), Cascading Style Sheet (CSS), Creating web pages, Lists, Hyperlinks, Tables, Web forms, Inserting images, Frames, Hosting options and domain name registration.	10
5	**Information Security**	Protection, Security, Risk, Threat, Vulnerability, Exploit, Attack, Confidentiality, Integrity, Availability, Non-repudiation, Authentication, Authorization, Codes, Plain text, Encryption, Decryption.	3
	Total		**27**

List of Experiments:

1. Introduction to various components of Computer system.
2. Study and Practice of handling Microsoft Windows – Folder related operations, My-Computer, Window explorer, Control Panel.
3. Introduction to Microsoft Office.
4. Creation and editing of Text files using MS Word.
5. Creation and operating of spreadsheet using MS Excel.
6. Creation and editing power-point slides using MS Power Point.
7. Introduction to Unix operating system (Ubuntu).
8. Study and practice of Open Office: OpenOffice Writer, OpenOffice Spreadsheet, OpenOffice Impress.
9. Study and practice of Basic Linux Commands.
10. Study and practice of Vim editor and its various commands in different modes.
11. Introduction to inter-networking protocols, world wide web, browsers and search engines.
12. Understanding of IP addresses, significance and uses of various domain names and URLs.
13. Create webpages and webforms including lists, hyperlinks, images, table etc. by using basic HTML program with HTML tag.

14. Modify the same webpages by using CSS codes.
15. Write the complete HTML coding using CSS for the following table:

Gradesheet of Diploma Students

	Maths	Physics	Chemistry	Human Values	Communication Skills	Engineering Themodynamics
Tom	47	39	25	33	43	36
Jimi	23	45	25	37	40	39
Tus	50	43	38	44	40	37
Ross	31	30	42	35	29	22
Max	34	35	38	44	49	43

16. Write the complete HTML coding using CSS for the following form :

Admission Form for Assam Energy Institute

First Name: enter your name   Last Name: enter your title

Password: enter your password

Select Gender: ○ Male ○ Female

Answer the following questions:

Why do you want to join Assam Energy Institute?

Which branch have you selected and why?

Submit Form

4. Readings:

4.1 References Books:

1. A. Goel, Computer Fundamentals, Pearson Education.
2. P. Aksoy, L. De Nardis, Introduction to Information Technology, Cengage Learning.
3. P. K. Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers.
4. R. S. Salaria, Computer Fundamentals, Khanna Publishing House.
5. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.
6. Andrew S. Tanenbaum, David J. Wetherall Computer Networks (5th Edition), PHI.
7. M. Merkow, J. Breithaupt, Information Security Principles and Practices, Pearson Education.
8. J. Minnick, Web Design with HTML5 and CSS3 (8th edition), Cengage Learning.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Describe functional units of a computer, its various peripherals and their applications.
2) Identify computer hardware as well as software (in the lab).
3) List the features of Word, Excel, PowerPoint and also able to perform calculations on excel sheet and demonstrate the use of PowerPoint for seminar presentations.
4) Identify various operating system file management commands (create, copy, move, delete and rename folders and files).
5) Demonstrate installation of application software in windows as well as in Linux operating system.
6) Acknowledge various computer languages and also able to differentiate between compiler and interpreters.
7) State computer networks such as LAN, MAN and WAN together with the internet, intranet and extranet.
8) Design basic web pages using the HTML along with the CSS.
9) Aware regarding the issues related to cyber security.

Engineering Workshop Practices Laboratory

1.1 Course Number: ME103L

1.2 Contact Hours: 0-0-3   Credits: 3

1.3 Semester-offered: 1st Year –Odd

1.4 Prerequisite: Class 10th level Mathematics

1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Dr. Abhimanyu Kar & Dr. Karthik Babu NB

2. Objective:

i) To get a hands-on basic training of various common manufacturing processes

ii) To understand the feasibility of different manufacturing processes depending on the raw materials and the product.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lab Sessions
1	**Carpentry**	Study of the joints in roofs, doors, windows and furniture, Hands-on-exercise: oodwork, joints by sawing, planning and cutting	2
2	**Fitting Shop**	roduction and practice of various fitting processes: Use of hand tools in fitting, preparing a male and female joint of M.S.	3
3	**Welding Shop**	roduction and practice of various Welding processes: Electric Arc welding Practice and Gas welding, TIG, MIG, Gas Cutting and application. Joints such as a Lap joint, a T-joint or a Butt joint are to be prepared.	2
4	**Machine Shop**	roduction and practice of various Machining processes: Plain and Stepped cylindrical turning, grooving, knurling and Thread-cutting of a job in lathe.	3
5	**Sheet Metal Work**	sics of Sheet Metal Work, essential properties required for sheet metal (malleable and formable), Forming & Bending, Model making – Trays and funnels, Different type of joints.	2
		Total	**12**

4. Readings

4.1 Textbooks:

1. Elements of Workshop Technology, Vol. I and II by Hajra Choudhary, Khanna Publishers

4.2 Reference Books:

1. Workshop Technology by WAJ Chapman, Viva Books
2. Workshop Manual by Kannaiah / Narayana, Scitech

5. Outcome of the Course:

1) Practical knowledge of the several manufacturing processes
2) Skills developed in carpentry, fitting welding, machining and sheet metal work
3) Basic idea of how things are produced in the industry

Chemistry Laboratory

1.1 Course Number: CY101L

1.2 Contact Hours: 0-0-2   Credits: 2

1.3 Semester-offered: 1st Year –Odd

1.4 Prerequisite: Class 10th level Chemistry

1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To incorporate the habit of working in laboratory while maintaining discipline, safety and integrity.

ii) To provide hands-on experience on the basic methods of quantitative analysis.

3. Course Content:

Sl. No.	List of Experiments
1	Introduction of a Chemistry Laboratory
2	Preparation of standard solution of oxalic acid or potassium permanganate.
3	Determination of strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator
4	Standardization of $KMnO_4$ solution using primary standard oxalic acid solution.
5	Determination of Fe content in Mohr Salt using $KMnO_4$ solution
6	Estimation of total hardness of given water sample using standard EDTA solution
7	Determination of Alkalinity of given water sample using known concentration of an acid
8	Determination of pH of given water sample
9	Determination of the total dissolved solid of a given water sample
10	Determination of viscosity of a solution using Ostwald viscometer

4. Outcome of the Course:

1) To prepare solution of a given strength

2) To use basic laboratory techniques and equipment such as titration, pH meter, viscometer etc.

3) To estimate of strength of acid /base and ions present in domestic/industry water

4) To estimate iron content in metal and alloys

5) To determine the quality of domestic/industry water

Universal Human Values

1.1 Course Number: HU101
1.2 Contact Hours: 1-1-0   Credits: 5
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: All Faculties of AEI

2. Objective:

i) To help the student see the need for developing a holistic perspective of life.
ii) To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
iii) To strengthen self-reflection
iv) To develop more confidence and commitment to understand, learn and act accordingly.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Motivation and Objectives of Human Values Course**	Introduction to the objectives of the course. Content and process of the course including mode of conduct. Daily life as lab for the course. Activities in the course.	2
2	**Purpose of Education**	How human being has a need for Knowledge, what should be the content of knowledge, how the content should be discussed in education. Complimentarily of skills and values, how the current education system falls short.	3
3	**Peers Pressure, Social Pressure**	In various dimensions of life, how do these things work. What is the way out? In the context of education, peer pressure etc.	2
4	**Concept of Competition and Excellence**	How competition leads to degradation of self and relationships. How excellence is the basic need of a human being. What is excellence?	2
5	**Time Management**	How does one deal with myriads of activities in college? Focus of the mind.	2
6	**Concept of Preconditioning**	How preconditioning affects our thinking, behavior, work, relationships, society and nature. How do we develop pre-conditioning? What are the various sources of preconditioning? How do we evaluate our	3

		Preconditioning? How do we come out of it?	
7	**Concept of Natural Acceptance in Human Being**	What is natural acceptance? How can the concept of natural acceptance be used to evaluate our preconditioning? Universal nature of natural acceptance. Are anger, jealousy, hatred natural? How do we feel when we experience them? Which feelings are natural for a human being and which are not?	3
8	**Understanding Relationships**	Are relationships important? What is the role of relationships in our life? If relationships are important then why they are important? If they are important then why it is the case that we are not discussing them? What are the notions/conditions and factors which stop us to explore more into relationships? Relationships in family and extended family. Dealing with anger, Basic expectations in relationships. Seven types of relations, Gratitude as a universal value in relationships, Nine universal values in human relationships, Trust as the founding value, Concept of acceptance, Unconditional acceptance in relationships, Our preconditioning affecting our relationships, Our relationships with subordinate staff, with people of opposite gender, caste, class, race, How relationships have the power to force a person to change his preconditioning.	4
9	**Concept of prosperity Material goods**	What role others have played in making material goods available to me: Identifying from one's own life.	2
10	**Idea of Society**	What is a society? What constitutes a society? What systems are needed for a society to work? What is the purpose of society and various systems which are working in it? How understanding of Human Nature is important in order to understand the purpose of Society and various social systems? And what happens when this understanding is lacking?	2
11	**Balance in nature**	Balance which already exists in nature, How human beings are disturbing the balance. Resource depletion and pollution, our own role in wastage of electricity, water and in use of plastics, Waste management, Issues like global warming, animal extinction	2
		Total	**27**

4. Readings

4.1 Suggested Readings:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. On Education - J Krishnamurthy
4. Siddhartha - Hermann Hesse
5. Old Path White Clouds -ThichNhatHanh
6. Diaries of Anne Frank - Anne Frank
7. Life and Philosophy of Swami Vivekananda
8. Swami Vivekananda on Himself
9. Small is Beautiful - E. F Schumacher
10. Slow is Beautiful - Cecile Andrews
11. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi
12. Rediscovering India - by Dharampal
13. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
14. India Wins Freedom -Maulana Abdul Kalam Azad
15. Autobiography of a Yogi – by ParamhansaYogananda
16. Gandhi and Question of Science – Sahasrabudhe

5. Outcome of the Course:

1. Analyze the significance of value inputs provided in formal education along with skills and develop a broader perspective about life and education.
2. Formulate their aspirations and concerns at different levels of living, and the way to fulfil them them in a sustainable manner.
3. Evaluate their current state of understanding and living and model a healthy lifestyle.
4. Examine the issues of home sickness, interactions with seniors on the campus, peer pressure with better understanding and feel grateful towards parents, teachers and others
5. Develop more confidence and commitment for value-based living in family, society and nature.

Communication Skills

1.1 Course Number: HU102

1.2 Contact Hours: 2-0-1   Credits:7

1.3 Semester-offered: 1st Year –Odd

1.4 Prerequisite: Class 10th level English

1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make the students confident of speaking in English impeccably and with utmost enthusiasm.

ii) To familiarize the students with different styles of communication.

iii) To enlighten the students with the seven concepts of communication.

iv) To make the students understand the nuances of communication.

v) To train the students and make them comprehend various aspects of Interview skills.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Parts of Speech**	Recognition and review of Nouns, Pronouns, Verbs, Adverbs, Adjectives, Prepositions, Conjunctions, Interjections, Knowledge of Courses/ Subjects, Object and Compliment of the Verb, Verbals –Infinitival, Gerund and Preposition Recognition and review	3
2	**Prepositions of time and place**	Contextual teaching of prepositions of time - on, in, at, since, for, ago, before, to, past, to, from, till/until, by Prepositions of place: in, at, on, by, next to, besides, near, between, behind, in front of, under, below, over, above, across, through, to, into, towards, onto, from	3
3	**Clause, phrases and Relative Clauses**	Basic definitions of clauses and phrases, Focus on Relative Pronouns and their use in sentences as relative clauses.	2
4	**Courses/Subjects Verb Agreement**	Rules that guide the agreement of the Courses/Subjects to its verb	2
5	**Sentence types and Transformation of**	Assertive sentences, Exclamatory sentences, Interrogative sentences, Negative sentences, Compound sentences, complex sentences, simple sentences, Degrees of Comparison	2

		sentences		
6	**Voice**	Change from Active Voice to Passive Voice and vice versa	2
7	**Punctuation**	Use of the comma, semi-colon, colon, apostrophe, exclamation mark, question mark and quotation marks	2
8	**Word formation**	Change of one part of speech to the other: from Verbs to Nouns, Nouns to Verbs, Adjectives to Nouns, Nouns to Adjectives, Verbs to adverbs, and Adverbs to Verbs	2
9	**Affixation**	Prefixes and Suffixes and new word formations	2
10	**Nominal Compounds**	Common nominal compound	2
11	**Paragraph Writing**	Descriptive Paragraph on various related topics.	2
		Total	**24**

4. Readings

4.1 Suggested Readings**:**

1. Essential English Grammar with Answers by Raymond Murphy (Cambridge University Press)
2. English for Polytechnics by Dr Papori Rani Barooah (Eastern Book House Publishers)
3. English Grammar by Annie Brinda (Cambridge University Press)

5. Outcome of the Course:

1) Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.
2) Understand and practice different techniques of communication.
3) Practice and adhere to the 7Cs of Communication.
4) Familiarize with different types of Communication.
5) Understand and practice Interview Etiquettes.

Semester II

Mathematics-II

1.1 Course Number: MA102

1.2 Contact Hours: 3-1-0   Credits:11

1.3 Semester-offered: 1st Year –Even

1.4 Prerequisite: Class 10th level Mathematics

1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. **Objective:**

This course is designed to give a comprehensive coverage at an introductory level to the subject of complex numbers, vector calculus, probability & statistics and differential equations (PDE and DE).

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Complex Numbers**	Definition of Complex numbers; Real and imaginary parts of a Complex number; Conjugate of a complex number; Modulus and amplitude of a complex number; Addition, Subtraction, Multiplication and Division of complex numbers, Polar and Cartesian form of a complex number and its conversion from one form to other, De-Movier's theorem and its application.	8
2	**Vector Calculus**	Definition, notation and rectangular resolution of a vector; Addition and subtraction of vectors; Scalar and vector products of 2 vectors; Simple problems related to work; moment and angular velocity. Gradient; Divergence and Curl.	8
3	**Ordinary Differential Equations**	Definition of differential equations; Order and degree of a differential equation; General and particular solution of a differential equation; Formation of differential equation whose general solution is given; Solution of first order and first-degree differential equation by variable separation method; Homogeneous differential equation of 1st order, Exact differential equation, First order linear differential equation.	9
4	**Partial Differential Equations**	Origin of PDE, Derivation of PDE, Lagrange's Method of Solving the Linear PDE of Order One, Charpit's Method of Solving equation of order one but of any degree.	9
5	**Probability and**	Definitions of probability and simple theorems,	8

	Statistics	conditional probability, Bayes Theorem, random variables, discrete and continuous distributions, Correlation and regression.	
		Total	**42**

4. Readings

4.1Textbook:

1. H. K. Das, Applied Mathematics for Polytechnics.
2. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40th
Edition, 2007.
3. Mathematics Textbook for Class XI and XII (NCERT).
4. R. D. Sharma, Mathematics for Class 11and 12.
5. E. kreyszig, Advanced Engineering Mathematics, Khanna Publisher.
6. M. D. Raisinghania, Advanced Differential Equation.
7. R. K. Jain and S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.

1.5 Reference Books:

1**.** J. W. Brown and R. V. Charchill**,** Complex variable & applications, McGraw Hills.
2. S. Narayan, A Text book of Vector algebra, S. Chand & CO.
3. J. J. Sciller, R. A. Srinivasan, M. R. Spiegel, Probability & Statistics, Schaum's outline series, McGraw Hill.
4. M. R. Spiegel, S. Lipschutz, D. Spellman, Vector Analysis, McGraw-Hill Book Company, New York.

5. Outcome of the Course:

1) The applications of complex numbers, vector calculus, probability & statistics in engineering and science related problems.
2) The technique of solving differential equations problems of engineering and science.

Physics-II

1.1 Course Number: PY102
1.2 Contact Hours: 3-1-0   Credits: 11
1.3 Semester-offered: 1st Year – Even
1.4 Prerequisite: Class 10th level Physics & Mathematics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Physics is a core science subject from which all engineering technologies have evolved, a thorough understanding of the basic principles and applied aspects will assist students in understanding, applying, and evolving technologies more effectively, thereby improving the quality of life in society.
ii) This course will provide the knowledge of the physical environment through observations and predictions.
iii) The course attempts to enhance the student's factual knowledge along with the applications. This will foster a scientific mindset and aid in the application of fundamental concepts and principles to engineering and technology-based challenges.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Wave motion and its applications**	Wave motion, Transverse and longitudinal waves with examples, Definitions of wave velocity, Frequency and Wavelength and their relationship, Sound and light waves and their properties, Wave equation, Amplitude, Phase, Phase difference, Principle of superposition of waves and beat formation. Simple Harmonic Motion (SHM): Definition, Expression for displacement, Velocity, Acceleration, Time period, Frequency. Simple harmonic progressive wave and energy transfer, Free, Forced and resonant vibrations with examples. Ultrasonic waves: Introduction and properties, Applications of ultrasonics in engineering and medicals.	7

2	**Optics**	Basic optical laws of reflection and refraction, Refractive index, Images and image formation by mirrors, Lens and thin lenses, Lens formula, Power of lens, Magnification of mirror & lens. Total internal reflection, Critical angle and conditions for total internal reflection, Applications of total internal reflection.	7
3	**Electrostatics**	Coulomb's law, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law: Application of Gauss law, Calculation of electrostatic potential at a point due to point charge, Relation between potential and electric field intensity. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical), Dielectric and its effect on capacitance, Dielectric breakdown.	8
4	**Current Electricity**	Electric Current, Resistance, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, Ohm's law and its verification, Kirchhoff's laws. Cells, Internal resistance, Concept of terminal voltage and Electromotive force (EMF). Chemical effect of current, Electrolysis, Faraday's law of electrolysis, Heating effect of current, Joule's law, Electric power, Electrical energy and related numerical problems, Advantages of electrical energy over other forms of energy.	7
5	**Magnetism & Electromagnetism**	Biot-Savart law, Magnetic lines of force, Uniform & non-uniform field, Magnetic flux, Ampere's circuital law, Solenoid, Lorentz Force, Direction of magnetic force, Permanent magnets and electromagnets, Magnetic force on a current-carrying conductor, Magnetic moment, Magnetic dipole, Torque on a current loop, Moving coil galvanometer, Conversion of a galvanometer into ammeter and voltmeter. Magnetization, Types of magnetic materials: Dia, para and ferromagnetic with their properties. Electromagnetic induction, Faraday's Laws, Lenz law, Self and mutual induction, Motional electromotive force, Eddy currents, Alternating current, Transformers (step-up & step-down), Displacement current, Electromagnetic waves	8

		and its spectrum.	
6	**Modern Physics**	Particle Aspect of Radiation: Black body radiation, Photoelectric effect, Experimental study of Photoelectric effect and Einstein's explanation, Wave aspect of particles: De Broglie waves, Wave particle duality, Uncertainty Principle. Electron Orbits, Alpha particle scattering experiment; Rutherford's model of atom, Bohr model, energy levels, hydrogen spectrum	5
		Total	42

4. Readings

4.1 Textbooks:

1. Textbook of Physics for Class XII (Part-1, Part-2); N.C.E.R.T., Delhi

4.2 Reference Books:

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by H. C. Verma, Vol. I & II, Bharti Bhawan Ltd., New Delhi.
3. Engineering Physics by P. V. Naik, Pearson Education Pvt. Ltd., New Delhi.
4. Engineering Physics by H. K. Malik and A. K. Singh, Mc Graw Hill.
5. Modern approach to Applied Physics- I and II, A. S. Vasudeva, Modern Publishers.
6. A Textbook of Optics, N. Subramanyam, Brij Lal, M. N. Avahanulu, S Chand and Company Ltd.
7. Introduction to Fiber Optics, Ajoy Ghatak and K. Thyagarajan, Cambridge University Press India Pvt. Ltd., New Delhi.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to;

1) Explain wave motion, periodic motion as well as simple harmonic motion and their basic parameters such as amplitude, frequency, wavelength, velocity and related numerical problems. Also, able to describe ultrasonic waves and its applications in engineering, medical and industrial areas.
2) Understand the basic optical laws of refraction and reflection, establish the location and characteristics of the images formed by mirrors and lenses. Also, able to explain critical angle, total internal reflection and its applications.
3) Describe electric filed, electric flux, electric potential along with the examples, also able to explain

the function of capacitors in simple circuits and solve simple problems.

4) Express electric current as flow of charge and concept of resistance. Also, able to list the effects of an electric current and its common applications, state Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, Faraday's law, Joule's law and their numerical applications.

5) Understand magnetism, its intensity, flux and related laws, explain the operation of appliances like moving coil galvanometer. Also, able to differentiate among different types of magnetic materials for engineering applications, learn the eddy currents, alternating current, displacement current and applications of electromagnetic induction in transformers.

6) Have basic idea of atomic structure and modern Physics regarding wave-particle duality, uncertainty principle.

Chemistry-II

1.1 Course Number: CY102
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Chemistry & Mathematics
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To apply the fundamental concepts of chemistry for the understanding of process and technology relevant to industry.
ii) To become familiar with the scope, methodology, and application of modern chemistry and to learn to appreciate its ability to explain the physical world.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Organic Chemistry**	General introduction, IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electrometric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions. Classification of Hydrocarbons: Aliphatic Hydrocarbon- Alkane, Alkene, Alkyne. Aromatic Hydrocarbon- Benzene: resonance, aromaticity; chemical properties: mechanism of electrophilic substitution – nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation.	6
2	**Alcohols, Phenols and Ethers**	Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to methanol and ethanol. Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols. Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.	6
3	**Energy & Environme**	Sources of Energy, Fuels- classification, examples, relative merits, types of coal, Gaseous fuels: LPG, natural gas, CNG:	8

	nt	Composition and applications. determination of calorific value of solid fuels, Bomb calorimeter, theoretical oxygen requirement for combustion, proximate & ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems. Knocking and anti-knocking for petrol and diesel (octane number and cetane number) - diesel index Industrial revolutions and pollution. Air/water/ soil pollution, greenhouse gas & effect, chemical reactions involved, acid rain, effects of depletion of ozone layer, greenhouse effect and global warming – pollution due to industrial wastes; remedies of pollutions.	
4	**Chemical Kinetics**	Rate of a reaction (average and instantaneous), factors affecting rates of reaction: concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation.	6
5	**Electroche mistry**	Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea),dry cell – electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.	6
Total			**32**

4. Reading

4.1 Suggested Reading:

1. NCERT Textbook (Class XI and XII)
2. Engineering Chemistry, B. K. Sharma
3. A Textbook of Engineering Chemistry, Sashi Chawla
4. Engineering Chemistry, Jain and Jain
5. Applied Chemistry, Dr. Raman Rani Mittal

4. Outcome of the Course:

After completion of this course students will able to

1) Explain why the element carbon gives rise to a variety of compounds, and how those organic compounds are classified and will learn about the naming of organic compound and basic concept of mechanism of organic reactions.

2) Learn about the name of of alcohols, phenols and ethers according to the IUPAC system of nomenclature. Understand the reactions involved in the preparation of alcohols and their corresponding chemical reactions.

3) Understand the importance of chemistry related to the environment, energy and fuels and importance of fuels in our daily life. Knowledge of environmental pollutions, green chemistry and water related chemistry.

4) Understand the factors that influence chemical reaction rates, reaction mechanisms, and the quantitative techniques used to describe those rates.

5) Understand the fundamental aspects of redox chemistry and the technologies made possible from discoveries in the field of electrochemistry and to identify the appropriate materials, design and operation conditions to reduce the likelihood of corrosion in engineering systems and operations.

Fundamentals of Electrical and Electronics Engineering

1.1 Course Number: EIE101

1.2 Contact Hours: 3-1-0   Credits: 11

1.3 Semester-offered: 1st Year –Even

1.4 Prerequisite: Class 10th level Mathematics & Science

1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma

2. Objective:

i) To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

ii) To introduce the students about domestic wiring, the functioning of various electrical apparatus and the safety measures. Emphasize the effects of electric shock and precautionary measures.

iii) To establish the basic knowledge of DC and AC electric circuits and magnetic circuits and its application in generators, motors, transformers.

iv) To introduce the students about basic knowledge of electronic components like Diode, BJT, FETs, Op-Amp, Digital Circuits etc. and their application.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**DC Circuit Analysis**	Electrical circuit elements (R, L and C), voltage and current sources, Series and parallel resistive circuits, Ohm's Law, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits. Source Transformation, Superposition Theorem, Thevenin and Norton's Theorem.	9
2	**AC Circuit Analysis**	A.C. Circuits: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.	10
3	**Magnetic Circuits and Electrical Machines**	Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Ideal and Practical transformer, Principle of operation, EMF equation. Construction and Working principle of AC and DC machines; Basic equations and characteristic of motors.	8
4	**Semiconductor**	Energy bands in solids, Types of materials (insulator, semi-	10

	Devices	conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of diodes. Diode as rectifier –half wave and full wave rectifier, Working of BJT, BJT as amplifier.	
5	**Introduction to Analog and Digital Circuits**	Introduction to Operational Amplifiers-Ideal, Practical Op-Amp, Inverting and Non-inverting amplifier. Introduction to Boolean Algebra, Logic Gates and their implementation as adder and subtractor, Flip-Flop and its application.	10
	Total		**47**

4. Readings

4.1 Recommended Books:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN:9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi,2015, ISBN-13: 0070634244-978
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504

5. Outcome of the Course:

After the completion of this course the students will be able to:

1) Demonstrate an understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

2) Demonstrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical devices like generators, motors and transformers etc.

3) Demonstrate an understanding of basic concepts of semiconductor material, electronics devices, and Digital electronics to perform the multidisciplinary tasks.

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Computer Programming

1.1 Course Number: CS102

1.2 Contact Hours: 2-0-2   Credits:8

1.3 Semester-offered: 1st Year –Even

1.4 Prerequisite: Class 10th level Computer knowledge

1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. Objective:

To enable student, develop structured solutions to problems and implementing them using computers. This involves two parts: i) Formulating a solution for a given problem as a well-defined sequence of actions, and ii) Expressing solution in a machine-readable form or a programming language.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics of C Programming**	1.1 Introduction to number system 1.2 Introduction to flowchart and algorithm 1.3 History of C, where C stands 1.4 C character set, tokens, constants, variables, keywords 1.5 C operators (arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special, operator precedence), C expressions data types. 1.6 Formatted input, formatted output.	7
2	**Decision Making**	2.1 Decision making and branching if statement (if, if-else, else-if ladder, nested if-else) Switch case statement, break statement. 2.2 Decision making and looping while, do, do-while statements for loop, continue statement.	7
3	**Arrays and Strings**	3.1 Arrays Declaration and initialization of one dimensional, two dimensional and character arrays, accessing array elements. 3.2 Declaration and initialization of string variables, string handling functions from standard library (strlen(), strcpy(), strcat(), strcmp()).	7
4	**Functions and Structures**	4.1 Functions: Need of functions, scope and life time of variables, defining functions, function call (call by value, call by reference), return values, storage classes. category of function (No argument No return value, No argument with return value, argument with return value), recursion.	7

		4.2 Structures: Defining structure, declaring and accessing structure members, initialization of structure, arrays of structure.	
		Total	**28**

4. Readings

4.1 Recommended Books:

1. Programming in C by Sachaum Series, McGraw Hills
2. Programming in C by Kerning Lan and Riechle Prentice Hall of India, New Delhi
3. Programming in C by BalaguruSwamy, Tata McGraw Hill, New Delhi
4. Let us C by Yashwant Kanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++
6. Programming in C by R Subburaj, Vikas Publishing House Pvt Ltd., Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi

5. Outcome of the Course:

Student will be able to computationally formulate basic problems and write code snippets to execute them. Also, the students will be able to take decisions when to use an array, when to use loop and when to use conditional statements.

Engineering Drawing

1.1 Course Number: ME102L
1.2 Contact Hours: 0-0-3   Credits:3
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Abhimanyu Kar & Dr. Karthik Babu

2. Objective:

i) To understand the basic concepts of dimensioning and scales and their roles in engineering drawing.
ii) To draw orthographic projections of points, straight lines, laminae and solids when the mentioned objects are located with different configurations with respect to the plane of projections.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Engineering Drawing**	1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. 1.2 Different types of lines in engineering drawing as per BIS specifications 1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments. 1.4 Free hand and instrumental lettering (alphabets and numerals) – upper case (capital letters), single stroke, vertical and inclined at 75degree, free hand and instrumental lettering in the ratio of 7:4	6
2	**Dimensioning Technique and Scales**	2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions) 2.2 Dimensioning of overall sizes, circles, angles, tapered surfaces, holes, counter sunk holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches 2.3 Scales – their needs and importance (theoretical	6

		instructions), type of scales, definition of representative fraction and length of scale	
3	**Orthographic Projections**	3.1 Theory of orthographic projections (elaborate theoretical instructions) 3.2 Projection of Points in different quadrants 3.3 Projection of straight lines (1st angle and 3rd angle) 3.4 Line parallel to both the planes 3.5 Line perpendicular to any one of the reference planes 3.6 Line inclined to any one of the references plane 3.7 Projection of planes – different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only. 3.8 Three views of orthographic projection of different objects	15
4	**Projection and Sections of Solids**	4.1. Definition and salient features of a solid 4.2. Types of Solid (polyhedral and solids of revolution) 4.3 To make projections, sources, top view, front view and side view of various types of solids. 4.4 Importance and salient features 4.5 Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. 4.6 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections. 4.7 Orthographic sectional views of different objects	9
5	**Isometric Views**	5.1 Fundamentals of isometric projections and isometric scale 5.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.	3
Total			**39**

4. Readings

4.1 Textbooks:

1. A Textbook of Engineering Drawing by Surjit Singh; Dhanpat Rai& Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria& Sons, New Delhi

3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I by DK Goel, GBD Publication.

4.2 Reference Book:

1. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

5. Outcome of the Course:

Knowledge of working with various drawing instruments.

1) Classify dimensioning methods and scales.
2) Understand the difference between first angle and third angle projection schemes.
3) Draw the orthographic and isometric views of simple objects.

Physics Laboratory

1.1 Course Number: PY101L
1.2 Contact Hours: 0-0-2   Credits:2
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Physics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Experiments demonstrate the principle of physics covered in the theory and also provide the familiarities with various apparatus along with developing an attitude of perfection in practical tasks.
ii) The basic purpose of laboratory experiments in physics is to verify and validate the concepts, principles and hypotheses related to the physical phenomena.

3. List of Experiments:

1. To determine the volume of an unknown cylinder using Vernier Callipers.
2. To determine the cross-sectional area of a thin wire using Screw Gauge.
3. To determine the radius of curvature of a convex lens using Spherometer.
4. To verify and understand the law of conservation of energy using simple pendulum.
5. To determine the angle of minimum deviation for a glass prism by plotting a graph between the angle of incidence and angle of deviation.
6. To measure the angle of incidence, angle of refraction and the angle of emergence of a rectangular glass slab and interpret the results.
7. To verify the laws of reflection of light using plane mirror.
8. To study the magnetic field lines formed around a Bar magnet.
9. To verify the Ohm's Law using a single resistance, two resistances connected in series and two resistances connected in parallel by plotting a graph of potential difference versus current.
10. To measure the value of an unknown resistance using meter bridge.

4. Readings (Textbooks / Reference Books):

1. Textbook of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi.
2. Comprehensive Practical Physics, Vol, I & II, J.N. Jaiswal, Laxmi Publications (P)Ltd.
3. Practical Physics by C. L. Arora, S. Chand Publication.

4. E-books/e-tools/ learning physics software/YouTube videos/websites etc.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Use various measuring device such as Vernier Callipers, Screw Gauge and Spherometer.
2) Understand the law of conservation of energy using simple pendulum.
3) Learn about the angle of minimum deviation of a glass prism using laws of refraction.
4) Verify the laws of reflection using mirror and the laws of refraction using glass.
5) Study the magnetic field lines of a Bar magnet.
6) Verify the Ohm's law and find an unknown resistance using meter bridge.

Fundamentals of Electrical and Electronics Engineering Laboratory

1.1 Course Number: EIE101L

1.2 Contact Hours: 0-0-2   Credits: 2

1.3 Semester-offered: 1st Year –Even

1.4 Prerequisite: Class 10th level Mathematics & Science

1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani &   Dr. Santosh Kumar Verma

1. Introduction to basic electrical circuit elements (R, L and C).
2. Study of CRO and Digital Multimeter
3. Measurement of Amplitude, Frequency and Time-period with the help of CRO.
4. Verification of the ohm's law.
5. Verification of KCL and KVL.
6. Verification of Mesh and Nodal Analysis for the given circuits.
7. Verification of Basic Theorems (The venin, Norton and Superposition).
8. Study of Step-up and Step-down Transformer.
9. Analysis of RLC circuit.
10. Study of speed control of DC motor.
11. Study of V-I Characteristics of PN-Junction Diode.
12. Study the operation of Half Wave and Full Wave rectifier.
13. Study of BJT and FET Characteristics.
14. Study the operation of Op-Amp in Inverting and non-inverting mode.
15. Verification of Basic Logic Gates.

Recommended Books:

1. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
2. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
3. Sedha, R.S., A text book of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978-8121927833
4. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504.

Community Internship

1.1 Course Number: HU103
1.2 Contact Hours: 1-1-0   Credits: 5
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: All Faculties of AEI

2. Objective:

i) Explore career alternatives prior to graduation.
ii) Integrate theory and practice.
iii) Assess interests and abilities in their field of study.
iv) Learn to appreciate work and its function in the economy.
v) Develop work habits and attitudes necessary for job success.
vi) Develop communication, interpersonal and other critical skills in the job interview process.
vii) Build a record of work experience.
viii) Acquire employment contacts leading directly to a full-time job following graduation from college.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Understanding Society**	Understanding Society Social structure and relationships, Social institutions and social groups, Socialization and social control: development of self	3
2	**Community Health**	Illness and Disease, Health and public health: Meaning, components, determinants of health, Wellbeing and Quality of life, Health as an aspect of social development, Nutrition and malnutrition, Community Health: relevance, needs assessment, developing mechanisms for people's participation, Community Mental Health	5
3	**Working with Groups**	Social Groups: Definitions, characteristics, functions and group structure, Principles of group work and Models of group work practice, Leadership - Theories of leadership, roles and	5

		responsibilities of group leader, Leadership Power, Leadership Styles, Leadership in Administration, Techniques and skills in group work,Group worker: roles and functions	
4	**Work with Communities**	Understanding Community: Definitions, types, approaches and framework, Community dynamics: Caste, class, religion and gender, Issues of identity, inclusion and exclusion, Community power structure, Community organization- principles, steps and process, Community work and community participation - Strategies and principles; Models and processes, Professionalism and inculcation of ethics in community practice	5
5	**Personality Development**	Definition of Personality, Determinants of Personality-biological, psychological and sociocultural factors, Communication, Flow and barriers of Communication, Listening, Spirituality and its role in personality development Stress: Causes, Management and Impact, Groups in organization, Interactions in group, Group Decision Taking, Team Building	5
6	**Development Communication**	Communication: concept, principles and its significance Process of Communication, Forms of communication: Verbal, non-verbal and written. Self-awareness in communication Barriers to communication	3
	Total		**26**

4. Readings

4.1 Suggested Readings:

1) Davis, K. 1969. Human Society, New York: The Macmillan.
2) Giddens, A.1999. Sociology, Cambridge: The Polity Press.
3) Dasgupta, M. & Lincoln, C.C. 1996, Health, Poverty and Development in India. New Delhi: Oxford University Press.
4) Trecker, H.B. 1972, Social Group Work: Principles and Practices. New York: Association Press.
5) Weil, M. (ed,) 1996, Community Practice: Conceptual Models. New York: The Haworth Press Inc.

6) Hergenhahn, B. R., &Olson., M. H. 2003, An Introduction to Theories of Personality, New Jersey: Prentice Hall.

5. Outcome of the Course:

As a result of participation in the course, students will be able to:

1) Assess and improve upon their own cultural competency skills.
2) Demonstrate understanding of theory and research guiding positive youth development programs.
3) Develop familiarity with positive youth development programs and approaches in building relationships with families and communities.
4) Understand how observation, documentation, and assessment are used to support children and families.
5) Develop applied professional skills to foster positive developmental outcomes for children and families.

Semester III

Fire Codes and Standards

1.1   Course Number: FSE201
1.2   Contact Hours:3-0-0   Credits:9
1.3   Semester-offered: 2nd Year –Odd
1.4   Prerequisite: Basic Science
1.5   Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To provide in-depth view of fire/combustion science.

ii) To introduce the concepts of fire protection/suppression engineering principles & systems currently followed in Oil & Gas industrial sector

iii) To brief the legislation requirements-national/international codes/ standards from fire & safety perspective

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	FIRE: Definition of Fire, Fire Triangle, Tetrahedron of Fire, Classification of fires, Types of Extinguishing Media of Agent, Principles of Fire Extinguishing Methods Cooling, Starvation, Smothering, Retarding Chain Reaction, Stages of Fire, various Products of combustion.	9
2	**National Building code-Part IV-Fire & Life safety**	Code & Standards in construction & Design of building. Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies. General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders.	9
3	**Specification of fire-fighting equipment**	Overview of Codes and Standards for active & passive fire protection system and materials.	8
4	**International Code & Standards**	International code & standard for Hydraulic platform, Turntable ladder and other Rescue and fire-fighting devices. Code, Standard and specification concerning to safety of fire-fighting personnel i.e., Breathing Apparatus P.P.E., safety gears and other devices.	8
5	**Scaffolding**	Code and Practice for construction of scaffolding. Scaffolding: Types, Parts, Hazards & Control Measures.	8
	Total		**42**

4. Readings

4.1 Reference Books and Standards:

1. National Building codes of India- Part IV (2016), Bureau of Indian standards
2. IS 3696-1: Safety code of scaffolds and ladders, Part 1: Scaffolds, BIS, Part 2-Ladders
3. IS 5896 (Part 3): Code of Practice for Selection, Operation, and Maintenance of Fire Fighting Appliances, Part 3: Turntable Ladder, BIS
4. IS 15105: Design and Installation of Fixed Automatic Sprinkler Fire Extinguishing Systems - Code of Practice, BIS
5. IS 6070: Code of practice for selection, operation and maintenance of trailer fire pumps, portable pumps, water tenders and motor fire engines, BIS
6. Sesha, P., Manual of Fire Safety
7. Jain, V.K., Fire Safety in Buildings

5. Outcome of the Course:

1) Gain knowledge on extinguishment of different kinds of fire & demonstrate the usage of various fire extinguishers.
2) Identify & explain different types of fire protection systems/ installations in oil and gas industry
3) Summarize the fire safety requirements for buildings of different occupancy as per the National Building Code of India

Materials Science and Engineering

1.1 Course Number: ME203

1.2 Contact Hours: 3-0-0   Credits: 9

1.3 Semester-offered: 2nd Year –Odd

1.4 Pre-requisite: Class-XII Physics

1.5 Syllabus Committee Members: Dr. Nilambar Bariha, Ms. Ananya Borah, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma

2. Objective:

i) To Understand the classification of materials, bonding and the crystal structure.

ii)To understand the Properties of conducting, insulating, semiconducting, dielectricand
   semiconductor materials.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Introduction and historical importance of Materials, Classification of Materials, Engineering Materials, Advanced Materials and Future Materials like ceramics, polymers, composites, Dielectric etc. Bravais Lattices, Crystal Structures, Crystalline, Quasi Crystalline and Non-Crystalline Materials, Miller Indices, Miller-Bravais Indices for Planes and Directions of Cubic and Non-Cubic Structures, structure of ceramics, polymers, and composites materials. Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect.	8
2	**Diffusion and Heat treatment**	Phase Diagrams: Phase Rule, Equilibrium Phase Diagrams, Phase Systems - Isomorphous, Eutectic with No and Limited Solid Solubility and Peritectic, Iron-Carbon Phase Diagram, TTT Diagram. Imperfections in Solids and Strengthening Mechanisms: Point Defects, Line Defects and Dislocations, Interfacial Defects and Bulk or Volume Defects, Recovery, Recrystallization and Grain Growth. Alteration of properties by heat treatment, Heat treatment method, Quantification of altered material properties by heat	9

		treatments.	
3	**Mechanical behavior of Metals and Alloys**	Types of Loading, Stress-Strain Curves for Brittle and Ductile Materials, Theoretical and Observed Shear Stress, Critical Resolved Shear Stress, Deformation – Elastic, Anelastic, Plastic and Super Plastic, Yield Criteria, Macroscopic Aspects of Plastic Deformation, Toughness Measurements by S-S Curve, Impact Testing and Fracture Toughness Testing. Types of Mechanical Loading and Failures: Ductile and Brittle Fracture, Modes of Fracture Toughness, Impact Fracture, Ductile-Brittle Transition, Types of Impact Testing, Fatigue, Crack Initiation and Propagation, Fatigue Testing, Creep, Stages of Creep Curve, Stress and Temperature Effects.	10
4	**Dielectric and Magnetic Property of Materials**	Introduction, polarization of dielectric material, dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity. Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.	8
5	**Properties of Metals and Semiconductors**	Energy band in Metals, Semiconductors and Insulators, types of semiconductors, Intrinsic and Extrinsic semiconductors, Effect of temperature on the electrical conductivity of metals, insulator and semiconductor, thermal properties, thermal conductivity of metals and semiconductors, factors affecting the resistivity of electrical materials, electrical conductivity of doped materials, thermoelectric effects.	7
Total			42

4. Readings

4.1 Textbooks:

1. C.S.Indulkar and S. Thiruvengadam, S., "An Introduction to Electrical Engineering".
2. P L Kapoor. A Textbook of Electrical and Electronics Engineering Materials: Khanna publishers
3. Kenneth G. Budinski, "Engineering Materials: Prentice Hall of India, New Delhi

5. Outcome of the Course:

After the completion of this course the student will be able to:

1) Describe the fundamentals of material science and concepts of unit cell & crystallography.
2)Classify materials based on their conducting, insulating, semiconducting, dielectric properties.
3) Know the practical uses of various materials in different electrical engineering field.

Unit Operations-I

1.1 Course Number- CE201
1.2 Contact Hours- 3-1-0   Credits: 11
1.3 Semester Offered- 2nd Year Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To study statics, kinematics and dynamics of fluids.
ii) To understand the characteristics associated with the fluid flow though pipeline systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fluid Statics**	Brief description of various fluid properties, Pressure at a point, Compressible and Incompressible fluid, Measurement of pressure, Manometry, Buoyancy, Archimedes' principle and stability	6
2	**Fluid Kinematics**	Classification of fluid flows – viscous vs inviscid flow, internal vs external flow, compressible vs incompressible flow, laminar vs turbulent flow, natural vs forced flow, steady vs unsteady flow, uniform vs non-uniform flow; Flow patterns – timeline, streamline, path line, streamline	9
3	**Fluid Dynamics**	Fluid flow rate, Conservation of mass, Continuity equation, The Bernoulli's equation and its application	9
4	**Pipe Flow**	Flow regimes in a pipe, Energy loss in pipes through Darcy-Weisbach equation and Hagen-Poiseuille equation, Friction factor, Turbulent flow in pipes, Moody's Diagram	9
5	**Pipeline Systems**	Basic of pipe network system, Minor losses in pipes, Energy and hydraulic grade line, Valves used in pipelines – Flow control valve, Check valve, Pressure relief valve/ Safety valves	6
Total			**39**

4. Readings

4.1 Textbooks/ Reference Books:

1) Elger, Donald F., Barbara A. LeBret, Clayton T. Crowe, and John A. Roberson. Engineering fluid mechanics. John Wiley & Sons, 2020.
2) Yunus, A. Cengel. Fluid Mechanics: Fundamentals and Applications (SI Units). Tata McGraw Hill Education Private Limited, 2010.
3) Fox, Robert W., Alan T. McDonald, and John W. Mitchell. Fox and McDonald's introduction to fluid mechanics. John Wiley & Sons, 2020.
4) R.K. Bansal, A textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

5. Outcome of the Course:

1) Knowledge of fluid properties, stress, buoyancy and floatation.
2) Classify fluid flow and flow pattern.
3) Understand continuity and Bernoulli equations.
4) Derive Darcy-Weisbach equation and Hagen-Poiseuille equation associated with pipe flow.
5) Calculate friction factor from Moody diagram.
6) Knowledge of minor & major losses and energy & hydraulic grade lines corresponding to pipe flow.
7) Classify flow control valves and safety valves.

Engineering Thermodynamics

1.1 Course Number- ME205
1.2 Contact Hours- 3-0-0   Credits: 9
1.3 Semester Offered- 2nd Year Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To understand basic concept of thermodynamics and its properties.
ii) To generate the ability to differentiate different forms of energy i.e., heat and work.
iii) To apply first law of thermodynamics to closed and flow systems.
iv) To realize the need of second law of thermodynamics, spontaneity and irreversibility in nature.
v) To learn basic concepts of real gases and working of external and internal combustion engines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basic concepts and definition**	Scope and limitations of Thermodynamics, Macroscopic and Microscopic approaches; Definition of System, Surrounding, closed systems, and open system; Properties: (extensive and Intensive), Characteristics of properties (point and path function), and its representation on a property diagram; Units of measurements: Force, Pressure, and Energy.	6
2	**Equilibrium and Zeroth Law**	Equilibrium: Thermal, Mechanical, Chemical, Thermodynamic; Zeroth Law of Thermodynamics and temperature, Measurement of temperature and calibration of Thermometers, the ideal gas temperature scale.	5
3	**Processes and its representation**	Reversible and Irreversible processes; Different types of process and their representations.	2
4	**Work and Heat Transfer**	Definitions and calculations: Work Transfer, Different modes of work, Displacement Work for various processes, Heat Transfer, Specific heat, Latent heat.	4
5	**First Law of Thermodynamics**	Joule's experiment, Introduction of internal energy as a thermodynamics property, Introduction of enthalpy as a	5

		thermodynamic property; Definition of specific heats and their use in calculation of internal energy and enthalpy with emphasis on ideal gases.	
6	**Applications of First Law of Thermodynamics**	Application of First Law to control mass: Work done and heat transfer in various types of elementary processes; Application of First Law to control volumes; Nozzle, Diffuser, Compressor, Turbine, Throttling device, Heat Exchanger. (Only steady flow need be considered).	8
7	**Second Law of Thermodynamics**	Limitations of first law of thermodynamics; Cyclic heat engine; Energy reservoirs; Refrigerator and Heat Pump; Kelvin-Plank statement and Clausius statement of second law; Reversibility and Irreversibility; Carnot Cycle and Carnot Theorems;	5
8	**Entropy**	Clausius' Theorem and Clausius' inequality; Concept of entropy; Entropy and Disorder; Entropy changes in various processes, Entropy Principle and its application,	5
		Total	**40**

4. Readings

4.1 Textbooks:

1. Engineering Thermodynamics by P.K. Nag, Publisher: TMH
2. Basic Engineering Thermodynamics by Rayner Joel, Pearson Education

4.2 Reference Books:

1. Engineering Thermodynamics by Van Wylen and Sontang, John Wiley
2. Engineering Thermodynamics by M. Achuthan, Publisher: PHI
3. Applied Thermodynamics by Eastop and McConkey, Publisher: Pearson
4. Fundamental of Engineering Thermodynamics by E. Rathakrishnan, publisher. PHI
5. Engineering Thermodynamics by Russel and Adebiyi, publisher, Oxford
6. Steam Tables in SI Units by Ramalingam, Scitech.

5. Outcome of the Course:

1) Basic understanding thermodynamics and its applications
2) Understand the basics of Engineering Materials (its applications) and Stress-Strain
3) Basic understanding of boilers, engines and latest automobile technologies.
4) Understand the basics Applied Mechanics, Simple lifting Machines & Power Transmission
5) Understand the basics of Engineering surveying and Smart Infrastructure Development.

Explosions and Industrial Fire Safety

1.1 Course Number: FSE202

1.2 Contact Hours: 3-0-0   Credits:9

1.3 Semester-offered: 2nd Year –Odd

1.4 Prerequisite: Fundamentals of Fire and Safety Engineering

1.4 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2.Objective:

i) To provide basic concepts of explosion hazards and its prevention measures.

ii) To provide in-depth knowledge of various processes involved in engineering industry and the associated hazards.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Explosion Characteristics**	Explosion hazards & different case studies, Flammability limits and Theories-Lean limit and Rich limit, LEL & UEL measurement techniques and equipment, Minimum ignition energy, Relation between auto-ignition temperature and flash point, Effect of temperature and pressure on flash point, Classification of flammable materials, Vapour cloud tank explosion.	6
2	**Explosion Prevention and Protection**	Explosion prevention techniques-Ventilation, Separation. Physical barriers. Alternative techniques, Preventing the formation of explosive atmosphere, Explosion protection systems - a. Protection techniques - Containment, Isolation, Suppression, Ventilation for explosion protection system, Explosion protection using inert gases, Flame arrestors and quenching distance.	9
3	**Safety in Welding & Gas Cutting**	Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions - safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection- pipe line safety-storage and handling of gas cylinders.	11
4	**Principles of**	Guarding during maintenance, Zero Mechanical	7

	Machine Guarding	State(ZMS), guarding of hazards-point of operation protective devices, machine guarding, types, fixedguard, interlock guard, automatic guard, trip guard, fixed guard fencing.	
5	**Safety in cold forming and hot working of metals**	Cold work, power presses, point of operation safeguarding, auxiliary mechanisms, feeding and cutting mechanism, Hot work- safety in forging, hot rolling mill operation, hazards and control measures. Safety in gas furnace operation, foundry health hazards, work environment, material handling in foundries. Work permit system in cold and hot working areas.	9
Total			**42**

4. **Readings**

4.1 Textbooks/ Reference Books:

1. Nolan, D.P., Handbook of fire and Explosion Protection Engineering Principles for Oil, Gas, Chemical and Related Facilities, 3rd Edition, William Andrew, 2018.
2. Laute, S., Explosion Hazards in the Process Industries, UK ed. Edition, Scitus Academics LLC, 2016.
3. Eckhoff, R.E., Explosion Hazards in the Process Industries, Gulf Professional Publishing Company, 2nd Edition, 2016.
4. Tarafdar, N.K., Tarafdar, K.J., Industrial Safety Management, Assorted Editorial, 2018.
5. Poonia, M.P, Sharma, S.C., Industrial Safety and Maintenance Management, Khanna Book Publishing, 1st Edition, 2019.
6. Deshmukh, L.M., Industrial Safety Management, McGraw Hill Education, 2017.

5.Outcome of the Course:

After completion of this course, the students will be able to

1) Identify hazards associated with various processes used in engineering industry.
2) Formulate the methods of safe operations by effectively controlling the occupational health and safety hazards.
3) Understand and apply safety requirements for safe material handling.

Unit Operations Laboratory – I

1.1 Course Number: CE201L

1.2 Contact Hours: 0-0-2   Credits: 2

1.3 Semester-offered: 2nd Year –Odd

1.4 Prerequisite: Diploma level Mathematics and Physics

1.5 Syllabus Committee Members: Dr. Bhaskar Jyoti Medhi, Dr. Anil Kumar Varma, Dr. Arun Kumar & Mrs. Sukanya Hazarika

2. Objective:

i) The lab is to provide practical and theoretical experience in a number of important chemical engineering unit operations ensuring a thorough understanding of the principles of unit operation. The course includes experimental execution, data analysis and error analysis, skills development in oral presentation, technical report writing, and team-building.

ii) The experiments are designed to illustrate the principles of fluid and particle mechanics, separation processes.

3. Course Content:

Sl. No.	List of Experiments
1	To verify the Bernoulli's equation
2	To study the head losses due to various fittings in pipeline
3	To study different types of flow
4	To measure the viscosity of oil using Redwood Viscometer
5	To measure the discharge through Venturi meter, Orifice meter and Rotameter
6	To study the Reciprocating pump characteristics
7	To study the Centrifugal pump characteristics
8	To study the operation of ball mill
9	To study the operation of gyratory sieve shaker
10	To study the working principle of froth flotation cell
11	To study the operation of plate and frame filter press

4. Outcome of the Laboratory:

This lab will give the student a thorough knowledge of fluid and particle mechanics, separation processes. Understand to analyze experimental data and observed phenomena to write good technical report.

Fire Ground Operations-I

1.1 Course Number: FSE202L
1.2 Contact Hours: 0-0-3   Credits:3
1.3 Semester-offered: 2nd Year –Odd
1.4 Prerequisite: NA
1.6 Syllabus Committee Members: Ms. Ananya Borah &Dr. Nilambar Bariha

2. Objective:

i) to familiarize students with the Fire Fighting equipment's.
ii) to understand the selection and operation of different types of extinguishers.

3. Course Content:

Sl.No.	List of Experiments
1	Classification of Fire and Extinguishing Methods – As Per Indian Standard (Is 15683:2018), British Standards and NFPA 10.
2	Fire Extinguishers- Basic Operations, Types and Color Coding.
3	Water Extinguishers- Method of Operation.
4	Carbon Dioxide Fire Extinguishers- Method of Operation.
5	Foam Fire Extinguishers- Method of Operation.
6	Dry Chemical Powder Fire Extinguishers- Method of Operation.
7	Wet Chemical Fire Extinguishers. - Method of Operation.
8	Selection and Maintenance of Fire Extinguishers.
9	Fire Hydrants- Its Types, Working Principle, Components and Color Coding.
10	Fire Hoses- Types, Couplings & Methods of Rolling Fire Hose.
11	Fire Hose Nozzles and Branch Types.
12	Fire Water and Foam Monitors.

4. Outcome of the Laboratory:

On completion of this course, the students will

1) Have the knowledge to select the correct firefighting equipment relative to its contents, capacity and limitations and operate it safely in the event of fire.
2) Will acquire practical knowledge on the usage of various firefightingequipment's.

Semester IV

Fire Hydraulics and Suppression System

1.1 Course Number: FSE205

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 2nd Year –Even

1.4 Prerequisite: Fire Codes and standards (3rd Semester)

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To provide in depth knowledge of various fire suppression agents and extinguishing Mechanisms.

ii) To gain knowledge on basic components of Fire Suppression System and its application.

iii) To provide an overview of basic Principles of Fire Hydraulics and its calculation.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Suppression Agents and Extinguishing Mechanisms**	Overview of suppression and extinguishment, Suppression agents/attributes, Portable Fire Extinguishers-Classifications of portable fire extinguishers, testing of portable fire extinguishers. Standpipe and Hose Systems - Basic components of standpipe and hose systems, Types of systems/ components/applications.	8
2	**Water and Foam based Suppression System**	Basic components of water and foam-based suppression systems. Types of water and foam suppression systems/components and its applications. Attributes of system components, Hazard classifications/System design criteria, Spacing/location /placement of discharge devices.	8
3	**Carbon Dioxide Suppression System**	Basic components of Carbon dioxide-based suppression systems- Carbon dioxide based suppression system operation-Standard for Carbon dioxide based suppression systems-Types- Types- Local application system- Total Flooding system- Inspection, Testing and maintenance. Hazards of Carbon dioxide-based suppression system.	8
4	**Dry Chemical and Wet Chemical Suppression System**	Basic components of Dry chemical & Wet chemical Suppression system- Fixed Dry chemical & Wet chemical Suppression system operation-Standards for Dry chemical & Wet chemical Suppression system- Types- Local application system- Total Flooding	9

		system-Inspection, Testing and maintenance.	
5	**Hydraulics Systems**	Overview of hydraulics-Definition "hydraulics" in fire protection Engineering, basic Principles of Hydraulics and its calculation, Water Supply Analysis, types of water supply, Hydraulics of Water Supplies for Automatic Sprinkler Systems. Principles of water flow in a piping system and through an orifice, Concept of friction loss and determine friction loss. Fire water demand for calculation for process plants.	9
	Total		**42**

4. Readings:

4.1 Textbooks/ Reference Books:

1. Watts, J.M., Hall, J.R., SFPE Handbook of Fire Protection Engineering, National Fire Protection Association Quincy, Massachusetts, (Society of Fire Protection Engineers, Boston), 3rd Edition, 2002.

2. Bromann, M., The Design and Layout of Fire Sprinkler Systems, Tyalor & Francis, CRC Press, 2nd Edition, 2001.

3. OISD-115 (Oil Industry Safety Directorate), (2002). Guidelines on Fire Fighting Equipment and Appliances in Petroleum Industry. <http://www.oisd.nic.in/oisd-std-115>.

4. OISD-116 (Oil Industry Safety Directorate), (2017). Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants. <http://www.oisd.nic.in/oisd-std-116>.

5. OISD-117 (Oil Industry Safety Directorate), (2017). Fire Protection Facilities for Petroleum Depots, Terminals, Pipeline Installations & Lube oil installations. <http://www.oisd.nic.in/oisd-std-117>.

6. OISD-142 (Oil Industry Safety Directorate), (1996). Inspection of fire-fighting equipments and systems. <http://www.oisd.nic.in/oisd-std-142>.

7. Lamalva, K.J., Hopkin, D., Structural Fire Engineering, Fire Protection Committee, American Society of Civil Engineers, 2018.

8. NFPA-13 (National Fire Protection Association), (2000). Standard for the Installation of Sprinkler Systems. <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards>

9. NFPA-15 (National Fire Protection Association), (2000). Standard for Water Spray Fixed Systems for Fire Protection. <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards>

5. Outcome of the Course:

On completion of this course, the students will be able to

1) Know the active and passive fire protection design and precaution in building or other industries/ premises.

2) Demonstrate the usage of various fire suppression system during any emergency
3) Calculation of fire water demand for various hazardous installations.

Fire Dynamics

1.1 Course Number: FSE206

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 2nd Year –Even

1.4 Prerequisite: Heat Transfer Operation

1.5 Syllabus Committee Members: Dr. Nilambar Bariha & Ms. Ananya Borah

2. Objective:

i) To understand about the combustion, chemistry, mass conversation, and its flame spread in the surrounding.

ii) To explain about the burning properties of materials, detail fire behaviour of materials, and building fire.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Combustion Fundamentals**	Chemical Thermodynamics and kinetics, Pyrolysis, ignition and combustion, conservation equations for mass, momentum, energy and species, turbulence, radiation.	8
2	**Ignition of Flaming Combustion**	Introduction, flashpoint, dynamics of evaporation, evaporation rates, Clausius-Clapeyron equations, estimate of ignition time components-Chemical time, mixing time, pyrolysis, ignition in thermally thin and thick solids, ignition properties of common materials, Heat flux in fire.	10
3	**Fire Dynamics**	Flames and fire spread theory, buoyant plumes, and interactions with surfaces, smoke spread, turbulent diffusion flames, soot formation and radiation effects, toxic products; fire chemistry, nitrogen and halogen thermochemistry, numerical techniques.	12
4	**Compartment Zone Fires**	Flashover, post-flashover, control, applications, numerical techniques, plume and ceiling jet models.	4
5	**Heat Transfer in Fire**	Heat transfer concepts, Forms of heat transfer, conduction-Steady state condition, thermal penetration time, convection and radiation-hot gases and smoky gases, heat flux from flames, heat flux as an indication of damage.	8
Total			**42**

4. Readings:

4.1 Reference Books:

1. Drysdale, D.D., An Introduction to Fire Dynamics, Wiley, New York, 1999.
2. Lyons, J.W., Fire, Scientific American Books, New York.
3. Karlsson, B., and Quintiere, J.G., Enclosure Fire Dynamics, CRC Press.
4. Cox, G., Combustion Fundamentals of Fire, Academic Press, London, 1995.
5. Haessler, W.M., Fire: Fundamentals and Control, Marcel Dekker, 1988.
6. SFPE, Handbook of Fire Protection Engineering, NFPA, Quincy, Mass.
7. Quintiere, J.G., Principles of Fire Behavior, Delmar, 1985.

5. Outcome of the Course:

Students will be able to

1) Understand the fire dynamics in building or forest fire.
2) Understand the basic of properties of burning of material and its chemical kinetics.
3) Design the building as per fire safety requirements.

Fire Detection System and Electrical Safety

1.1 Course Number: FSE207

1.2 Contact Hours:3-0-0   Credits:09

1.3 Semester-offered: 2nd Year –Even

1.4 Prerequisite: Fundamentals of Electrical and Electronics Engineering

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To provide an overview of Fire alarm & detection system used in various Industrial installations.

ii) To provide in-depth view of electrical safety at workplace as per national/international standards, codes and/or rules

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fire Detection System**	Introduction of detection devices, Alarm and detection system, Basic function of Fire alarm & detection system-Type of detectors- Smoke Detector-Smoke detector Classification- Heat detector – Heat detector Classification- Flame Detector- Flame Detector Classification-Method of selection- Working Principle-Advantages and disadvantages of various detection devices.	9
2	**Introduction about Electrical Safety and Management**	Introduction – electrostatics, electromagnetism, stored energy, energy radiation and electromagnetic interference –Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation (CPR).	8
3	**Electrical Hazards**	Primary and secondary hazards - shocks, burns, scalds, falls - Human safety in the use of electricity - Classes of insulation-voltage classifications - current surges- over current and short circuit current-heating effects of current electrical causes of fire and explosion. Lightning hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.	9

4	**Electrical Protection Systems**	Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage –safe distance from lines - overload and short circuit protection. Earth leakage circuit breaker (ELCB) - use of low voltage-electrical guards-Personal protective equipment. Role of environment in selection-protection and interlock self-diagnostic features and fail-safe concepts-lock out and work permit system - safety in the use of portable tools-cabling and cable joints-preventive maintenance.	9
5	**Hazardous Zones**	Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification- use of barriers and isolators.	7
	Total		**42**

4. Readings

4.1 Reference Books:

1. Rao, S., Electrical Safety Fire Safety Engineering and Safety Management, Khanna Publications, 2nd Edition, 2012.
2. Fordham Cooper, W., Electrical Safety Engineering, Butterworth and Company, London, 2006.
3. Indian Electricity Act and Rules, Government of India.
4. Cadick, J., Electrical safety Handbook, Third Edition, McGraw Hill, 2006

5. Outcome of the Course:

1) Describe the phenomenon of electrical hazards associated causes, effects and prevention/protection measures.

2) Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.

3) Explain the working principles and applications of various kinds of Fire alarm & detection system.

Safety in Construction

1.1 Course Number: FSE208
1.2 Contact Hours:3-0-0   Credits:9
1.3 Semester-offered: 2nd Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To provide knowledge of various safety practices followed in Construction site
ii) To provide in-depth knowledge of various work carried in Construction site
iii) To familiarize the student applicable Statutory regulations, acts, Regulations

3.CourseContent:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Accidents Causes and Management Systems**	Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accidents – The Building and other Construction workers (Regulation of Employment and conditions of Service) Central Rules, 1998, Contract document & contractual clauses Precontract activities, preconstruction meeting–Project HSE Plan-design aids for safe construction, permits to work, Personal protective equipment, Recording of accidents and safety measures, Education and training.	9
2	**Hazards of Construction and Prevention**	Excavations, Trenches, Erection of structural framework, dismantling–tunneling–blasting, confined spaces–working on contaminated sites–workover water Safety during Demolition–Cordoning–Dismantling–Clearing debris House keeping – accidents due to poor housekeeping.	9
3	**Fall Prevention and Fall Protection**	Fall prevention and fall protection - Fall protection in construction – OSHA requirement for working at heights, Different types of scaffolds – Design, safe erection, use and dismantling, scaffold inspection checklist, requirement for safe work platforms, stairways and ramps. Safe access and egress – safe use of ladders- Safety Harnesses, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, Height pass –accident case studies.	8

4	**Safety in Huge Structures**	Safety in typical civil structures – Dams-bridges-water Tanks-Retaining Walls-Critical factors for failure-High rise buildings, Road works, and Power plant constructions	8
5	**Construction Machinery**	Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks–use of conveyors concrete mixers, concrete vibrators–safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, Inspection and Maintenance, Hand tools, Manual Material handling.	8
Total			**42**

4.Readings

4.1 Reference Books:

1. Mishra, R.K., Construction Safety Paperback, 2013.
2. Herberle, D., Construction Safety Manual, McGraw-Hill, 1998.
3. Holt, A.S., Principles of Construction Safety Paperback, 2005.

5.OutcomeoftheCourse:

On completion of this course the student will be able to:

1) Understand the safety requirements in various construction operations and develop guidelines to ensure safety at construction site.
2) Learn and apply the legal provisions with respect to the health and welfare of workers at construction site.
3) Understand the safety requirements in material handling and equipment's and develop guidelines to ensure safety at construction site

Unit Operations - II

1.1 Course Number: CE206
1.2 Contact Hours: 3-1-0   Credits:11
1.3 Semester- offered: 2nd Year –Even
1.4 Prerequisite: Diploma level Mathematics and Physics
1.5 Syllabus Committee Members: Dr. Bhaskar Jyoti Medhi, Dr. Anil Kumar Varma,
 Dr. Arun Kumar & Mrs. Sukanya Hazarika

2. Objective:

To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topic	Sub-Topics	Lectures
1	**Introduction**	Heat and Modes of heat transfer: Conduction, Convection, Radiation, Concept of steady state and unsteady state heat transfer, Analogy between flow of heat and electricity.	4
2	**Conduction**	Thermal conductivity, Fourier's law of heat conduction, Steady state equation, Heat flow equation for composite walls, Composite cylinders, Spheres, Insulation and insulating materials, Critical insulation thickness.	8
3	**Convection**	Nature of heat convection, Dimensional analysis and significance of various dimensional groups, Forced convection (No derivation), Free convection (No derivation)	8
4	**Thermal Radiation**	Nature of thermal radiation, Absorption, Transmission, Reflection and Emission of radiation, Emissive power of black body, Plank's distribution, Total emissive power, Stefan-Boltzman law, Emissivity, Kirchoff's law, Black body, Wien's displacement law.	6
5	**Heat Exchangers**	Introduction, Types of Heat Exchangers, Overall Heat Transfer Coefficient, Construction and Description of Various Types of Heat Exchangers, Logarithmic Mean Temperature Difference, LMTD for Parallel and Counter Current Heat Exchangers.	8
6	**Boiling, Condensation and Evaporation**	Interface, Bubble and Film boiling, Boiling regime, Concept of condensation, Types of condensation: Drop wise and Film wise condensation, Evaporation: Introduction, Liquid characteristics, types of evaporator,	6

		economy & capacity, method of feeding, examples based on single effect evaporator.	
		TOTAL	**40**

4. Readings:

4.1 Textbooks:

1. J. P. Holman, Heat Transfer, McGraw - Hill.
2. B. K. Dutta, Heat Transfer, Prentice Hall of India.

4.2 Reference Books:

1. D.Q. Kern, Process Heat Transfer, Tata McGraw - Hill.
2. W. L. McCabe, J. Smith and P. Harriot, Unit Operations of Chemical Engineering, McGraw-Hill.

5. Outcome of the Course:

Students completing the course will be able to:

1) Understand basic laws associated with conduction, convection and radiation and its applications.
2) Analyze problems involving steady heat conduction in simple geometries.
3) Understand the concept of convective heat transfer and to analyze the problems involving heat transfer coefficients for natural and forced convection
4) Analyze heat exchanger performance using LMTD and use it for parallel or counter flow
5) Recognizer various type of heat exchanger working principle, and basic geometries of heat exchanger.
6) Determine the overall heat transfer coefficient for a heat exchanger.
7) Understand the concept of boiling and condenser.
8) Analyze the performance of evaporator.

Fire Ground Operation-II

1.1 Course Number: FSE209L
1.2 Contact Hours:0-0-3   Credits:3
1.3 Semester-offered: 2nd Year –Even
1.4 Prerequisite: Fire Ground Operation-I
1.5Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To provide in-depth knowledge about the various Tenders and operations and the different firefighting system used in Industry.
ii) To be familiar with various regulations, safety procedures, equipment, techniques and personnel necessary to operate at a confined space emergency
iii) To make the students understand the various rescue procedures and techniques used during the time of emergency.

3. Course Content:

Sl.No.	List of Experiments
1	Fire Water Pumps- Components, Types and Methods of Operation.
2	Sprinkler System- Types, Working Principle and Method of Operation.
3	Sprinkler Head- Types and Color Coding.
4	Foam- Types of Foam Compound and Their Classification.
5	Operation of Fire Water and Foam Monitors.
6	Selection, Operation, Maintenance and Hydro test of Fire Hose.
7	Demonstration of Self-Contained Breathing Apparatus (SCBA).
8	Confined Space Entry Procedures.
9	Use of Portable Multi-Gas Detector.
10	Work Permit System- Types and Procedures.
11	Demonstration of Mock drills and Rescue Operation.
12	Personal Protective Equipment's- Types and Uses.
13	Fire Tender- Components, Types and Method of Operation.
14	Fire Alarm System- Components, Types and Method of Operation.

5. Outcome of the Course:

After completion of this course, the students will be able to

1) Handle emergency situations efficiently by using different rescue procedures.
2) Know the concepts of personal protective equipment and its usages.
3) Gain an overview of work permit systems.

Semester V

Disaster Management and Emergency Preparedness

1.1 Course Number: FSE301

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 3rd Year –Odd

1.4 Prerequisite: Health, safety and Environment

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To understand the basic concepts of disaster management and promote awareness of different types of disasters and their impacts.

ii)To impart knowledge to create appropriate planning, preparation and response for emergency treatment in disaster situation.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Man made Disasters: Difference, Nature, Types and Magnitude, Disaster management act, 2005	8
2	**Repercussions of Disasters and Hazards**	Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	9
3	**Disaster Prone Areas in India**	Study of SeismicZ ones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post Disaster Diseases and Epidemics	8
4	**Disaster Preparedness and Management**	Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.	9

5	**Risk Assessment**	Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.	8
		Total	**42**

4. Readings

4.1 Reference Books:

1. Goel, S.L. Disaster Administration and Management Text and Case Studies, Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Rai, N. Singh, A.K. Disaster Management in India: Pe respective, issues and strategies, New Royal book Company, 2007.
3. Pardeep, S. Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi,2001.

5. Outcome of the Course:

1) Understand the world-wide distribution of hazards and disasters and know the similarities and differences between natural and technological disasters.
2) Gain preparedness skills that increase community effectiveness in responding to disaster.

Hazard Identification and Risk Analysis

1.1 Course Number: FSE302
1.2 Contact Hours:3-0-0   Credits:9
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Nilambar Bariha & Ms. Ananya Borah

2. Objective:

i) To understand the occurrence of hazards that are present in the workplace and its awareness.
ii) To learn the concepts of uncertainty, probability, and variability.
iii) To provide in-depth knowledge of safety in the design and operation of process plant.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Hazard, Risk Issues and Hazard Assessment**	Introduction, hazard, hazard monitoring- risk acceptance levels, Risk estimation. Risk communication, Implementation and review, Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.	11
2	**Reliability and Fire Risk Assessment**	Component Life, Failure Rate, Estimating the parameters of a Distribution, System Reliability, Bayesian Methods. Probability Models in Fire Protection Engineering: Fault Tree & Event Tree Analysis, Human Error Analysis-Safety Review System-Hazard Warning, Methods-Hazard Warning Analysis- Plant Safety Audit. Introduction, Taxonomy of Methods for Fire Risk Assessment, Schedules, Insurance Rating, Dow's Fire and Explosion Index.	12
3	**Statistics Analysis**	Introduction, Basic concept of statistical analysis, Key parameters of descriptive statistics, Correlation, Regression and Analysis of Variance.	4
4	**Risk Control & Management**	Impact estimation: Property, People, Man and Machine System, Job and Personal Risk Factors-Standards-Selection and Training-Body Size and Posture-Body	8

		Dimension (Static/Dynamic)- Adjustment Range- Penalties. -Guide Lines for Safe Design and Postures- Evaluation and Methods of Reducing Posture Strain.	
5	**Risk Analysis Simulation Software for Fire Protection**	Basic Concepts of Risk Analysis - Quantitative - Qualitative Methods - Hazard Assessment Systems - Hazard Operability Studies (HAZOP) - EFFECTS - Hazard Analysis (HAZAN) -Failure Mode and Effect Analysis (FMEA), Layer of Protection Analysis (LOPA)-Safety Integrity Level (SIL)-Basic concepts of Reliability- Software on Risk analysis, ALOHA and Bowtie Analysis.	7
		Total	**42**

4. Readings

4.1 Reference Books:

1. Watts, J.M., John R. Hall, J.R., Fire Risk Analysis, SFPE Handbook of Fire Protection Engineering, National Fire Protection Association Quincy, Massachusetts, (Society of Fire Protection Engineers, Boston), 3rd Edition, 2002.
2. Clement, G.A., Law of Fire Insurance, Nabu Press Primary Source Edition, 2013.
3. AIChE/CCPS, Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 2nd Edition 1992.
4. Fire Protection Handbook (Volume 1&2), National Fire Protection Association (NFPA), 20th Edition, 2008.
5. Hasofer, A.M., Beck, V.R., Bennetts, I.D., Risk Analysis in Building Fire Safety Engineering, Butterworth-Heinemann, Elsevier Publication, 1st Edition, 2007.
6. Wells, G., Hazard Identification and Risk Assessment, Institution of Chemical Engineers, 1997.
7. Lees F.P. Loss Prevention in the Process Industries, Butterworths, London, 2nd Edition 1996.

5.Outcome of the Course:

Students will be able to

1) Carryout Risk assessment methods to various Industries and work practices and activity
2) Create Bow tie diagram, ETA, FTA and FMEA
3) Understand advantage and disadvantage of various risk analysis techniques

Health, Safety and Environment

1.1 Course Number: FSE303

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 3rd Year –Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To create the awareness among students regarding importance of safety in industries.

ii) To introduce the definitions, concepts, methodologies used in management of occupational safety in industries.

iii) Students will be able to recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Occupational health and safety management**	General definitions: Health, safety, environment protection, occupational accident, hazard, risk, near misses, health and safety culture. Key elements for health and safety system - Importance of health and safety policy, aim and objective of health and safety policy -Health and safety culture, factors influencing health and safety culture -Influencing factors for health and safety management.	9
2	**Behavior based Safety**	Philosophy of safety - Need of safety philosophy - Safety psychology -Need of safety psychology - Meaning and aim of safety psychology -Factors affecting safety at work: attitude, aptitude, frustration, morale, motivation, individual differences.	9
3	**Safety Aspects in Confined Space**	OSHA Guideline for Confined Space Entry, Permit Requirement for Confined Space Entry, Duties of Persons involved in Confined Space Entry.	8
4	**Work Permit System**	Cold work permit system, Hot work permit, Confined space work permit, Electrical related work	8

		permit, Work at height Permit.	
5	**Environment**	Scope and Importance; need for public awareness about our environment; Economic and social security; Environment impact of transportation and Mining. Environmental Impact Assessment (EIA) — purpose, procedure and benefits of EIA; Biodiversity and its conservation; Sustainable development. Global warming and greenhouse effect, urbanization, acid, ozone layer depletion and nuclear accident.	8
		Total	**42**

4. Readings

4.1 Reference Books and Standards:

1. Safety, Health and Working Condition in the Transfer of Technology - Inter National Labor Office
2. Industrial Safety, Health and Environment Management System - RK Jain and Sunil S Rao
3. Publications from Inter National Standard Organizations like ISO, OSHA, IOSH, NEBOSH etc.
4. Encyclopedia of Occupational Health and Safety - Inter National Labor Office

5.Outcome of the Course:

On completion of this course, students will be able to-

1) Demonstrate the knowledge and understanding of basic terms in safety management.
2) Understand safety organizational requirements for effective safety management.
3) Evaluate the workplace hazards and apply controls measures using hierarchy of control.

Smoke Management System

1.1 Course Number: FSE304
1.2 Contact Hours:2-0-0   Credits:6
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Nilambar Bariha & Ms. Ananya Borah

2. Objective:

i) To understand about the smoke development, measurements and its toxic effects in the surrounding.
ii) To understand about the ventilation and its importance in building construction.
iii) To learn about the smoke control reduces the movement of smoke and air circulation in a large structural building.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Smoke Production in Fires**	Smoke measurements, Mass yields/mass fractions/molar yields/molar fractions. Smoke release rate/heat release rate. Visibility through smoke, influence of ventilation on smoke production.	5
2	**Principles of Smoke Movement**	Air flow principles, Gas expansion, Buoyancy/stack effect/local heating.	7
3	**Principles of Smoke Management**	Objectives of smoke management, Passive smoke management methods, Active/mechanically assisted smoke management methods. Opposed air flow Stairwell pressurization Zoned smoke control Smoke exhaust.	8
4	**Smoke Management for Large Spaces**	Venting requirements, Natural ventilation through roof and wall openings, Mechanical smoke exhaust systems, Complex Smoke Management system.	7
5	**Heating, Ventilation, and Air Conditioning (HVAC) Systems**	HVAC Engineering Equations for Daily Use, HVAC Engineering Fundamentals, Electrical Features of HVAC Systems, Sustainable HVAC Systems.	9
Total			**36**

4. Readings

4.1 Reference Books:

1. Klote, J.H., Milke, J.A., Turnbull, P.G., Kashef, A., Ferreira, M.J., Handbook of Smoke Control Engineering, Amer Society of Heating, Atlanta, 2012.
2. Klote, J.H., Milke, J.A., Principles of Smoke Management, American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.1791 Tullie Circle, N.E. Atlanta, 1992.
3. Schifiliti, R.P., Design of Detection Systems, SFPE Handbook of Fire Protection Engineering, 3rd Edition, National Fire Protection Association Quincy, Massachusetts, (Society of Fire Protection Engineers, Boston), 2002, Ch. 3-1.
4. Shapiro, J., Standpipe and Hose Systems, Fire Protection Handbook, 17th Edition, ed A.E. Cote (NFPA), Ch. 5-14, 1991.
5. Haines, R.W., Myers, M.E., HVAC Systems Design Handbook, 5th Edition, McGraw Hill, 2009.
6. Khalil, D.E.E, Khalil, E.E. Sprinklers and Smoke Management in Enclosures, 1st Edition CRC Press, 2020.

5.Outcome of the Course:

Students will be able to

1) Learn the fundamentals of smoke control system and their importance to a facility of fire protection.
2) Evaluate the smoke exhaust calculation and identify the toxic effects to humans.
3) Identify the hazards and effects of personal exposure to occupants to airborne contaminants for eventual risk assessment.

Humanities

1.1 Course Number: HU301

1.2 Contact Hours: 2-0-0   Credits:6

1.3 Semester-offered: 3rd Year –Odd

1.4 Prerequisite: Diploma level English

1.5 Syllabus Committee Members: DUGC

2. Objective:

i) Foster intellectual curiosity, global knowledge, critical thinking, personal responsibility, and ethical and cultural awareness.

ii) Prepare students to use language effectively.

iii) Establish a framework for students to develop an aesthetic appreciation for fine arts.

iv) Prepare students to be responsible citizens, lifelong learners, and world-ready leaders in their chosen fields.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Sociology**	Definition of sociology, some sociological concepts: social structure, status, role, norms, values etc. Socialization, and culture and change. Social stratification - various approaches and concept of social mobility. Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world. Major social institutions - Family and marriage, caste and tribe and organizations: (i) formal organization (bureaucracy) (ii) informal organization. Processes of social change - Modernization (including Sanskritization), industrialization, environmental/ecological changes and development. Social movements - protest movements, reformist movement and radical movements in India.	9
2	**Introduction to**	Nature of Literature: Literature as a Humanistic	7

	Literature	Experience. Definitions: (i) Humanities: concern with culture, values, ideologies; (ii) Literature: concepts of imitation, expression, intuition & imagination. Major Themes of Literature: Nature, Science, Selfhood, Love, Rebellion. The Language of Literature: Modes of literary and non-literary expression. The concepts of Figurative language, imagery, symbolism, style. The Forms of Literature: Prose Narratives (short stories & novels) Poetry, Drama and Essays (Suitable texts are to be chosen by the instructors), Use of a Learner Dictionary.	
3	**Introduction to Philosophy**	Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsifications, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism, and under-determination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories. Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence, and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviorist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics	7
		Total	23

4. Readings

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4.1 Textbooks/Reference Books:

(A) Introduction to Sociology:
   (a) L. Broom, P. Selznick and D. Dorrock, Sociology, 11th Edn. 1990 (Harper International).
   (b) M. Haralambos, Sociology: Themes and Perspectives, Oxford University Press, 980.
   (c) M.S.A. Rao (ed) Social movements in India, vols. 1-2, 1984, Manohar.
   (d) David Mandelbaum, Society in India, 1990, Popular.

(e) M.N. Srinivas, Social change in modern India, 1991, Orient Longman.

(f) Guy Rocher, A. General Introduction to Sociology, MacMillan, 1982.

(B) Introduction to Literature:

(a) David Murdoch (ed.). The Siren's Song: An Anthology of British and American Verse, Orient Longman, 1988.

(b) S. Alter & W. Dissanayake (eds.) The Penguin Book of Modern Indian Short Stories. Penguin Books (India), 1989.

(c) Bertrand Russell, Impact of Science on Society. Allen &Unwin, 1952.

(d) Henrik Ibsen, A Doll's House, Macmillan India, 1982.

(e) George Orwell, Animal Farm, Penguin, 1951.

(f) J. Bronowski. The Ascent of Man, BBC, 1973.

(C) Introduction to Philosophy:

(a) A.C. Grayling (ed.) Philosophy: A Guide through the Courses/Subjects, Oxford Univ. Press, London, 1995.

(b) Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London, 1968.

(c) I.B. Cohen, The Birth of a New Physics, Vakils, Feffer and Simons Pvt. Ltd., Bombay, 1968.

(d) H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990.

(e) K.E. Goodpaster and K.M. Sayre (eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979.

(f) S.D. Agashe, A. Gupta & K. Valicha (eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press, 1963.

5.Outcome of the Course:

Students will demonstrate:

Knowledge of the conventions and methods of at least one of the humanities in addition to those encompassed by other knowledge areas required by the General Education program.

Engineering Economics

1.1 Course Number: HU302
1.2 Contact Hours: 2-1-0   Credits:8
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level Mathematics
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make fundamentally strong base for decision making skills by applying the concepts of economics.

ii) Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.

iii) Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Economics**	Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.	14
2	**Value Engineering**	Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications –Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples all methods.	12
3	**Cash Flow**	Methods of comparison of alternatives – Present worth	12

		method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples all methods.	
	Total		**38**

4. Readings

4.1 Textbooks:

1. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd, 2001.
2. Smith, G.W., "Engineering Economy", Lowa State Press, 1973.

4.2 Reference books:

1. Park, C.S., "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Newman, D.G. and Lavelle, J.P., "Engineering Economics and Analysis", Engineering Press, 2002.
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R, "Engineering Economy", Macmillan, 1984.
4. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., "Principles of Engineering Economy", Ronald Press, 1976.

5.Outcome of the Course:

Upon completing the course, students will be able to:

1) Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
2) Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.
3) Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.

Fire Ground Operation –III

1.1 Course Number: FSE305L
1.2 Contact Hours:0-0-3   Credits:3
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. Objective:

i) To help the students understand the fundamentals and relevance of first aid and Deal with emergency situations
ii) To enable students to understand Know the limits of basic first aid and Legal perspective of First Aid, Safety at the workplace and highlights of accident prevention.
iii) To expose students to a wide range of duties of the employer as a First Aider.

3. Course Content:

S.No.	List of Experiments
1	First Aid – Introduction, Aims of First Aid, Roles & Responsibilities of a First Aider.
2	Contents of First Aid Kit.
3	First Aid Techniques: Dressings, Bandages and Transportation of Injured Person.
4	First Aid Measures to be Taken for a Person Suffering from Heat Stroke at the Accident Site.
5	First Aid for Electric Shock and Electrical Burns.
6	First Aid for Fractures, Dislocations, Sprains and Strains.
7	Emergency First Aid Cardio Pulmonary Resuscitation (CPR) Procedures.
8	First Aid for Burns and Scalds.
9	First Aid for Heavy Bleeding.
10	First Aid for Eye Injuries.

4. Course Outcomes:

On completion of this course, the students will be able to

1) Gaining knowledge of principles of first aid
2) Gaining knowledge on human anatomy and safety tools during emergency
3) Demonstrate Cardiopulmonary Resuscitation.

Semester VI

Modeling and Simulation of Enclosure Fires

1.1 Course Number: FSE309

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 3rd Year –Even

1.4 Prerequisite: Basic Science and Fundamentals of Fire Engineering

1.5 Syllabus Committee Members: Dr. Nilambar Bariha & Ms. Ananya Borah

2. Objective:

i) To understand about the physical models for turbulence, heat transfer, combustion production of gaseous species, flame spread and soot in compartment fire.

ii) To provide knowledge of how the spread of fire and combustion gases is simulated using Computational Fluid Dynamics (CFD).

iii) To understand the limitations of the numerical and physical models used in modeling of compartment fires.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Description of Enclosure Fires**	Introduction, General Description of the Process of Combustion, Fire Growth in an Enclosure, Stages in Enclosure Fire Development, Fire Development in Terms of Enclosure Temperatures and Flow through Openings, Factors Influencing Fire Development in an Enclosure, Factors Controlling Energy Release Rates in Enclosure Fires, Burning Rate and Energy Release Rate, Enclosure Effects, Energy Release Rates Based on Free Burn Measurements. Design Fire- Background, Growth Phase, Steady Phase, and Decay Phase.	12
2	**Fire Plumes and Flame Heights**	Flame Characteristics, Turbulent Fire Plume Characteristics, Ideal Plume-Assumptions, Initial Considerations, Continuity Equation for Mass, Momentum and Buoyancy Equation, Plume Equations Based on Experiments- Zukoski Plume, Heskestad Plume, McCaffrey Plume, Wall and Corner Interactions with Plumes, Line Source Plumes. Ceiling Jets- Ceiling Jet Temperatures and Velocities, Flame Extensions under Ceilings.	11
3	**Pressure Profiles and Vent Flows for Well-**	Characteristics of Pressure, Application to a Simple Example, Mass Flow Rate through Vents, Pressure Profiles in a Fire Room with a Vent, Well-Mixed Case-	6

		Mass Flow Rates and Height of the Neutral Plane, Mass Flow Rate in through an Opening, Taking into Account the Mass Produced in the Room (the Burning Rate), Stratified Case-Mass Flow Rates.	
	Ventilated Enclosures		
4	**Computer Modeling of Enclosure fire**	Thermodynamics, equation of state, chemical and phase equilibrium, Pressure Poisson equation, Scalar transport schemes, non-dimensional forms of the governing equations, Compressible and low-Mach number, thermal radiation.	8
5	**Simulation in Enclosure fire**	Basic Simulation Approaches, Handling Stepped and Event-based Time in Simulations, Extinction, ignition, under-ventilated combustion, toxic products (CO, soot), Fire suppression, Model validation and uncertainty quantization (model input and output).	**5**
	Total		**42**

4. Readings:

4.1 Reference Books:

1. Janssens, M.L., Introduction to Mathematical Fire Modeling, 2nd Edition, Technomic Publication, CRC Press, 2000.
2. Karlsson, B., Quintiere, J.G., Enclosure Fire Dynamics, 1st Edition, CRC Press, 1999.
3. Yeoh, G.H., Kwok Kit Yuen, K.K., Computational Fluid Dynamics in Fire Engineering: Theory, Modelling and Practice, Butterworth-Heinemann, Elsevier Publication, 2008.
4. Cox, G., Combustion Fundamentals of Fire, Academic Press Inc., 1995.
5. Delichatsios, M.A., Air Entrainment into Buoyant Jet Flames and Pool Fires, SFPE Handbook, 1st Edition, (Society of Fire Protection Engineers, Boston), 1988, Ch. 1-19.
6. Emmons, D.D., Ceiling Jet Flows, SFPE Handbook, 1st Edition, (Society of Fire Protection Engineers, Boston), 1988, Ch. 1-8
7. Evans, D.D., Ceiling jet flows, SFPE Handbook, 1st Edition, (Society of Fire Protection Engineers, Boston), 1988, Ch. 1-9.

5.Outcome of the Course:

After completion of the course, the students will be able to-

1) Learn about the basis of mathematical models involving algebraic and differential equations used in compartment fires.
2) Learn about the target affected in each damage state and the associated time at which occurs in CFD.
3) To estimate the yield & calculation the species concentration of smoke in fire.

Industrial Pollution and Control

1.1 Course Number: CE310
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 3rd Year –Even
1.4 Prerequisite: Diploma level Chemistry and Chemical Technology
1.5 Syllabus Committee Members: Dr. Bhaskar Jyoti Medhi, Dr. Anil Kumar Varma, Dr. Arun Kumar & Mrs. Sukanya Hazarika

2. Objective:

To learn the essential principles used in industrial pollution control and also understand the important issues in industrial pollution control and importance of different environmental acts and legislations.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topic	Sub-Topics	Lectures
1	**Types of environments and their pollutants**	Classification of pollutants, Legislative aspects including water act. 1974, Air Act 1981 and effluent standards, EPA Air pollution: Sources and effects of different air pollutants, Sampling and analysis of air pollutants, Air pollution control methods and equipment, Cyclone separator, Baghouse, ESP, Venturi scrubber.	10
2	**Water pollution**	Sources, sampling and classification of water pollutants, determination of basic parameters and computations associated with: BOD, COD, TS, TDS, SS; Waste water treatment: primary, secondary, tertiary and advanced; aerobic treatment with special reference to activated sludge, trickling filter, RBDC and RBRC, EA, Non-conventional: WSP, anaerobic treatment with special reference to AFFR, UASB.	10
3	**Solid waste management**	Sources and classification, Public health aspects, Methods of collection and disposal methods: Open dumping, Landfill, Incineration, Composting, Vermiculture; Solid waste management using bioremediation for specific pollutants like chromium. Mercury, Ammonia/ urea, Phenolic sludges. Management and handling of Bio-medical waste; E-	10

		waste-classification and re-use and disposal, Hazardous waste management- Electro-chemical and photo-chemical oxidation - dye waste, chrome slag – case studies.	
4	**Pollution control in selected process industries**	Fertilizer industries, Petroleum refineries and petrochemical units, Pulp and paper industries, Tanning industries, Sugar industries, Dairy, Alcohol industries, Electroplating and metal finishing industries, Radioactive wastes, Ranking of wastewater treatment alternatives. Case Studies.	10
		TOTAL	40

4. Readings:

4.1 Textbooks:

1. C. S. Rao Environmental Pollution Control Engineering, New age Publishing.
2. Connwell and Devis, Introduction to Environmental Engineering, Tata McGraw - Hill Publishing Co. Ltd.

4.3 Reference Books:

1. Metcalf and Eddy, Wastewater Engg, Tata McGraw - Hill Publishing Co Ltd.
2. S.P. Mahajon Pollution Control in process industries, Tata McGraw - Hill Publishing Co Ltd.
3. S.J. Arceivala, Wastewater treatment for pollution control, Tata McGraw - Hill Publishing Co Ltd.

5. Outcome of the Course:

Students completing the course will be able to:

1) Demonstrate comprehensive understanding of various types of pollution from chemical industries and various regulations pertinent to air, solid and water pollutions.

2) Suggest process modifications in order to reduce pollution and waste from a chemical industry.

3) Design gravity settling chamber, cyclones, electrostatic precipitator, fabric filters and absorbers for air pollution control.

Legal Aspects of HSE

1.1 Course Number: FSE310

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 3rd Year –Even

1.4 Prerequisite: Health, Safety and Environment

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2.Objective:

i) To create the awareness among students regarding the various legislations applicable to industries.

ii) To introduce the definitions, concepts, requirements of various safety, health environment and welfare related acts and rules.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Factories Act**	Definitions, Preliminary, Inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions. Dock Workers (Safety, Health and Welfare) Act-Definitions, Powers of inspectors, Power of Govt. to direct inquiry, Obligation of dock workers. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.	9
2	**Worker's Compensation Act**	Definitions, Employer´s liability for compensation, Calculation of amount of compensation. ESI Act and Rules: Applicability, Definitions and Benefits. Public Liability Insurance Act and Rules- Definitions, Calculation of amount of relief, Environmental Relief Fund, Advisory Committee, Powers of District Collector, Extent of Liability, Contribution to Relief Fund.	8
3	**Explosives Act & Petroleum Act**	Definitions, Categories of Explosives, General Safety Provisions, Use of Explosives, Grant of license, Notice of Accidents, Inquiry into ordinary and more serious accidents, Extension of definition to other	9

		explosive substances. Explosives Rules, SMPV Rules and Gas Cylinder Rules (in brief). Petroleum Act with important rules - definitions, safety in the import, transport, store, license, exemption, notice of accidents.	
4	**Environmental Regulations**	General powers of the central government, prevention, control and abatement of environmental pollution Biomedical waste (Management and handling Rules), 1989-The noise pollution (Regulation and control) Rules, 2000- The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974. Central and state boards for the prevention and control of air pollution powers and functions of boards – prevention and control of air pollution and water pollution.	8
5	**International Occupational Safety Standards**	Occupational Safety and Health act of USA (The William- Steiger's Act of 1970) – Health and safety work act (HASAWA 1974, UK) – OHSAS 18000 – ISO 14000 – ISO 45001 - Benefits and Elements.	8
	Total		**42**

4. Readings:

4.1 Reference Books

1. Factories Act.1948
2. The Dock Workers (Safety, Health and Welfare) Act, 1986
3. Workmen Compensation act ,1923
4. The Public Liability Insurance Act, 1991
5. Petroleum act,1934 & Petroleum Rules, 2002, PESO
6. The explosives Act,1884; Explosive Rules,2008
7. "The Environment Act (Protection) 1986 with allied rules", Law Publishers (India) Pvt. Ltd., Allahabad.
8. "Water (Prevention and control of pollution) act 1974", Law publishers (India) Pvt. Ltd., Allahabad.
9. "Air (Prevention and control of pollution) act 1981", Law Publishers (India) Pvt. Ltd., Allahabad.

5. Outcome of the Course:

On completion of this course, students will be able to-
1) Gain knowledge on laws relevant and concerning towards welfare, working hours and health and safety of workers engaged in industries.
2) Understand and learn about the legal aspects granting of license for storage, transportation and usage of explosive and flammable substance as per various acts and rules.
3) Learn concept, agencies and provisions are per various environmental laws.
4) Evaluate the compliance legal and other requirements in a workplace.

Incident Investigation and Safety Audit

1.1 Course Number: FSE311
1.2 Contact Hours:3-0-0   Credits:9
1.3 Semester-offered: 3rd Year –Even
1.4 Prerequisite: Health, Safety and Environment
1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2. **Objective:**

i) To give students a foundation on theories of accident causation and prevention methods and carryout systematic accident investigation to identify the root causes.
ii) In-depth learning of inspection, auditing process, fire investigation & fire risk assessment.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Safety Management**	History of Safety movement-Evolution of modern safety concept- general concepts of management –line and staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.	8
2	**Safety Audit**	Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor-IS14489 : 1998 Code of practice on occupational Safety and health audit.	9
3	**Accident Investigation and Reporting**	Concept of an accident, near miss incident, reportable and non-reportable accidents, reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents, departmental accident reports,	9

		documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident.	
4	**Safety Performance Monitoring**	Recommended practices for compiling and measuring work injury experience – permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate, Total Injury illness incidence rate, lost workday cases incidence rate (LWDI), Number of lost workday's rate– problems.	8
5	**Safety Education Training**	Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training DGFASLI, NSC, ASSE, HSE, OSHA-NEBOSH – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge safety incentive scheme, safety campaign.	8
	Total		42

4. Readings:

4.1 Textbooks/ Reference Books:

1. Guidelines for Auditing Process Safety Management Systems, Second Edition,Author(s): Center for Chemical Process Safety
2. Mckinnon, R.C. The Design, Implementation, and Audit of Occupational Health and Safety Management Systems,2020.
3. Stephen, A. Health and Safety, Environment and Quality Audits: A Risk based Approach, Stephen Asbury.3rd edition, 2018.
4. IS 3786: Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents By Bureau of Indian Standards

5.Outcome of the Course:

On completion of this course, students will be able to

1) Understand accident investigation methodologies and apply systematic procedure to identify the root causes of incident.

2) Carry out fire safety audit, incident investigation being a fire safety auditor, advisor, investigator, and recommend suitable control measures.

3) Formulate recommendations for corrective action recommendations, make audit reports, and conduct follow-ups.

Departmental Elective/Open Elective

Fundamentals of Environmental Impact Assessment

1.1 Course Number: FSE312

1.2 Contact Hours:3-0-0   Credits:9

1.3 Semester-offered: 3rd Year –Even

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2.Objective:

i) To introduce the concepts, procedures and methodology of Environmental Impact Assessment (EIA).

ii) To develop a critical awareness to evaluate the environmental aspects of business operations.

iii) To expose the students to the need for environmental impact assessments and how to prepare the various EIA documents.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) -Environmental Risk Assessment (ERA) - Legal and Regulatory aspects in India – Types and limitations of EIA - Terms of Reference in EIA- Issues in EIA - national – cross sectoral - social and cultural.	9
2	**Environmental Analysis and Assessment Techniques**	Components - screening - setting - analysis - prediction of impacts - mitigation. Matrices - Networks - Checklists. Importance assessment techniques - cost benefit analysis - analysis of alternatives - methods for Prediction and assessment of impacts - air - water - soil - noise - biological - cultural - social - economic environments. Standards and guidelines for evaluation. Public Participation in environmental decision-making.	9
3	**Environmental Impact**	Trends in EIA practice and evaluation criteria - capacity building for quality assurance, Expert System	8

	Assessment Evaluation	in EIA - use of regulations and AQM.	
4	**Environmental Management Plan**	Document planning - collection and organization of relevant information - use of visual display materials – team writing - reminder checklists. Environmental monitoring - guidelines - policies - planning of monitoring programmes. Environmental Management Plan. Post project audit.	8
5	**Case Studies**	Case studies of EIA of developmental projects.	8
	Total		**42**

4. Readings:

4.1 Reference Books:

1. Khandeshwar, S.R., Raman, N.S., Gajbhiye, A.R., Environmental Impact Assessment, S. R. Khandeshwar N.S. Raman, A.R. Gajbhiye, Dreamtech Press, (2019).
2. Yerramilli, A. Manickam, V.Environmental Impact Assessment Methodologies, BS Publications, 3rd Edition, (2020).

5.Outcome of the Course:

On completion of this course, students will be able to-

1) Know the key steps in the EIA process.
2) Understand the importance of Social Impact Assessments and public participation in the EIA process.
3) Gain an overview of methods and instruments that are commonly used to develop an EIA.

Occupational Health and Industrial Hygiene

1.1 Course Number: FSE313

1.2 Contact Hours: 3-0-0   Credits:9

1.3 Semester-offered: 3rd Year –Even

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Ms. Ananya Borah & Dr. Nilambar Bariha

2.Objective:

i) Understand the aspects of industrial hygiene and occupational health

ii) Identify occupational health issues and the relevant risk reduction solutions

iii) Gain core skills and knowledge to recognize, evaluate and control hazardous substances in the workplace, encompassing hazards such as chemical, physical (eg noise, radiation), biological and ergonomic agents;

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Anatomy, Physiology, Hazard and Pathology**	Definition- Anatomy and Physiology of human organs – The lungs, Skin, Ear, Eyes and skin – Functions of organs – Impairment of organs – Effects of various hazards on organs - Cardio pulmonary resuscitation - audiometric tests, eye tests, vital functional tests. Exposure routes of toxic materials and protective mechanisms, Recognition of health hazards, Methods for measuring and evaluating health hazards.	8
2	**Physical Hazards**	Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, noise surveys, noise control program, industrial audiometry, hearing conservation programs-vibration, types, effects, instruments, surveying procedure, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard- non-ionizing radiations, effects, types, radar hazards, microwaves and radio waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures of hot environments, thermal comfort, heat	9

		stress indices, Industrial illumination and design of lighting system.	
3	**Chemical Hazards**	Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. Dose, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, personal sampling Methods of Control- Engineering Control, Design maintenance considerations, design specifications- General Control Methods - training and education. Toxicology cosmetics– human health risk assessment and Environmental risk assessment.	9
4	**Biological and Ergonomical Hazards**	Classification of Bio-hazardous agents – examples, bacterial agents, viral agents, fungal, parasitic agents, infectious diseases – Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Ergonomics-Definition-Role of ergonomics at workplace Work Related Musculoskeletal Disorders	8
5	**Occupational Health, Physiology and Toxicology**	Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax.	8
	Total		42

4.Readings:

4.1 Textbooks/ Reference Books:

1. Fundamentals of Industrial Hygiene, 6th Edition National Safety Council; 6th Edition 2012.
2. Essentials of Industrial Hygiene, 1st Edition National Safety Council, 2015.
3. Barbara, A.P., Quinlan, P.J., MPH, CIH, Villareal, J., Hand book of Fundamentals of Industrial Hygiene, 6th Edition, National Safety Council, 2012.
4. Occupational Health Safety Management Practical Approach, CRC Press Taylor & Francis, 2nd Edition, 2008.
5. Koradecka, D., Handbook of "Occupational Safety and Health", CRC Press, 2010.
6. Fuller, T.P., Handbook of Essentials of industrial hygiene, National Safety Council ItascaIL, 2015.

5.Outcome of the Course:

On completion of this course the student will be able to:

1) Describe the nature of the health effects associated with exposure to industrial agents
2) Analyze and apply industrial hygiene strategies with respect to chemical, biological, and physical hazards.
3) Identify industrial hygiene standards, testing systems, and monitoring techniques. Recognize, assess, and control chemical, biological, and physical hazards.

Industrial Pollution and Control Laboratory

1.1 Course Number: CE310L
1.2 Contact Hours: 0-0-2/2   Credits:1
1.3 Semester-offered: 3r^d Year –Even
1.4 Prerequisite: Diploma level Mathematics and Chemistry
1.5 Syllabus Committee Members: Dr. Bhaskar Jyoti Medhi, Dr. Anil Kumar Varma, Dr. Arun Kumar & Mrs. Sukanya Hazarika

2. Objective:

To study the physical, chemical and biological water quality parameters. The course includes experimental execution, data analysis and error analysis, skills development in oral presentation, technical report writing, and team-building.

3. Course Content:

Sl. No.	List of Experiments
1	To determine the Total Solids of a given sample
2	To find out Total Dissolved Solids of a given sample
3	To find out Fixed and Volatile solids of the given sample
4	To determine the Acidity of the given sample
5	To determine the Alkalinity of the given sample
6	To determine the Total Hardness of the given sample
7	To find out amount of Sulphates in a given sample
8	To estimate the content of Chlorides in the given water sample
9	To find the quantity of the Dissolved Oxygen present in the given sample
10	To determine the BOD of a given wastewater sample
11	To determine the COD of a given wastewater sample

4. Outcome of the Course:

The lab will give the student a thorough understanding to analyze different waste water samples.

Simulation of Fires in Enclosures laboratory

1.1 Course Number: FSE309L

1.2 Contact Hours: 0-0-2/2   Credits:1

1.3 Semester-offered: 3r^d Year –Even

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Dr. Nilambar Bariha and Ms. Ananya Borah

Sl. No.	List of Experiments
1	To create a model geometry of given enclosures data.
2	To define the fire and its thermal conditions inside the enclosures.
3	To create a mesh and define boundary conditions of given enclosure data.
4	To define the simulation parameters of given enclosures data.
5	To define the simulation time-steps and viewing the results of given enclosures data.
6	Modeling heat conduction problem in PyroSIM.
7	Simulation of Burner Fire using PyroSIM.
8	Modeling of Smoke Movement in Building by using PyroSIM.